



THE FN MINIMI LIGHT MACHINE GUN

M249, L108A1, L110A2, and other variants

CHRIS McNAB



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THE MINIMI LIGHT MACHINE GUN



CHRIS McNAB

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Author's note

The word 'mil' stands for 'milliradian', and here refers to a common trigonometric measurement used in optical sights on firearms. The mil dot markings on a sight reticle enable a gunner to calculate elevation and windage to strike the target over different ranges.

Editor's note

In this book linear, weight, and volume measurements are given in US customary units of measurement (yards, feet, inches, pounds, ounces, grains). The following data will help when converting between US customary and metric measurements:

1yd = 91.44cm

1ft = 30.48cm

1in = 2.54cm

1lb = 0.45kg

1oz = 28.35g

1 grain = 0.002oz

1 grain = 0.065g

Front cover, above: The M249 SAW. (Public Domain)

Front cover, below: A US soldier of the 25th Infantry Division fires an M249 SAW down an Alaskan range during his qualification training on the weapon in 2015. (Justin Connaher/ US Air Force)

Title-page image: Firing his SAW from a tripod mount, a US Marine quickly switches between targets, aiming via the Advanced Combat Optical Gunsight (ACOG) sight mounted atop the feed cover. (USMC)

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INTRODUCTION

While this book is first and foremost a history of one particular type of machine gun, the FN Minimi, it is also in part the story of the ammunition the Minimi fires: the 5.56×45mm NATO. This particular aspect of the narrative is replete with controversy, strong opinions, conflicting research, and above all the hunt for the perfect light machine gun (LMG). As will become clear, that quest is far from over.

Through navigation of these themes, it is evident that the FN Minimi is one of the most successful firearms concepts of the last half-century. Emerging from the legendary creativity of Fabrique Nationale (FN; also known as FN Herstal after its headquarters in Belgium) in the 1970s, the Minimi took the world of military firearms by storm. To date, it has been adopted by more than 75 countries, including as the standard LMG of the US armed forces, and has been battle-tested and trialed in every conceivable type of terrain, environment, and conflict. As we shall see, the assessment of the Minimi has, at different times and in various forms of service, been mixed. I will argue that the essential quality and fundamental performance of the gun itself are confirmed, as is its place in the tactical make-up of the modern infantry fire team.

Returning to the subject of ammunition, to understand the controversy surrounding the 5.56mm round we have to go back to the 1950s, when the postwar militaries were thinking about the next generation of infantry weapons. World War II had seen the introduction of the “intermediate” rifle round, at first in the form of the German 7.92×33mm *kurz* (short) round for Nazi Germany’s MP 44 Sturmgewehr, the world’s first true assault rifle. (A case can be made for the US M1 Carbine having introduced the intermediate round, but the latter’s straight case design and limited range qualify that claim somewhat.) What was “intermediate” about the 7.92mm *kurz* was that it essentially sat between the pistol round and rifle round in terms of power and performance. In practical terms, this meant that the MP 44 could comfortably handle full-automatic fire, unlike a



shoulder-mounted weapon firing a full-power rifle cartridge, but the cartridge still delivered decent penetration and a flat trajectory over typical combat ranges (200–600m; 219–656yd).

The rest of the world took notice. In the aftermath of the war, the Soviets made the first move, creating the legendary AK-47 assault rifle in the late 1940s, chambered for the 7.62×39mm. Significantly, the Soviets had also applied that round to a new LMG, the RPD, introduced into Soviet service in 1944, before the AK-47. The intermediate rounds were fed into the gas-operated RPD via 100-round non-disintegrating belts, which were held in a drum magazine. The British were also conducting postwar experiments with new types of ammunition, in particular their .280in (7mm) round for the EM-2 bullpup rifle. This line of investigation was quashed, however, when the United States enforced its will in the selection in 1954 of a new NATO standard cartridge for battle rifles and machine guns: the potent 7.62×51mm NATO. For a short time at least, it seemed as if there would be an East/West split in terms of the philosophical approach to ammunition, with the Eastern Bloc leaning toward the intermediate cartridge for its assault rifles and LMGs, while the West standardized on the full-power rifle round for its rifles, LMGs, and medium machine guns (MMGs); but the question was far from settled. During the late 1950s, the US government and firearms industry began to explore the development of a lighter round for its troops, focusing on the development of cartridges of .223in/5.56mm caliber that delivered the

A machine-gunner with Company E, Battalion Landing Team 2/4, fires an M249 SAW (Squad Automatic Weapon) at 750rd/min during a US Marine Corps heliborne raid training exercise. (USMC)

requisite performance through ultrafast velocities of around 3,280ft/sec. The .223in Remington cartridge became the 5.56mm M193 in military designation, and was adopted as a standard type in 1963. It went into the next generation of US military rifle, the M16, though against considerable resistance from the old guard, who resented the “plastic rifle” and what they saw as a cartridge lacking in penetration and range. What the 5.56mm round offered was the ability for the soldier to carry nearly twice as much ammunition into battle as his 7.62mm-armed comrade, and to deliver stable full-automatic fire. In addition, the impact fragmentation of the M193 led to some astonishing (although often mythologized) wounding effects when fired from the M16. Momentum now built up within NATO to switch to the lighter caliber, and in 1977 the 5.56×45mm NATO was selected as the replacement for the 7.62mm round in rifles. While the United States already had the M16, the rest of the world began developing a new generation of rifles to take the cartridge.

So where did machine guns fit into this picture? Traditionally, all except the heaviest varieties of machine gun had fired the standard full-power rifle round of the day. This made sense: machine guns have greater requirements for range, penetration, and attrition than standard-issue rifles, and the beefy rifle cartridge satisfies those requirements. Yet with the RPD, and its later version the RPK, the Soviets had shown that the intermediate cartridge could be utilized for a light squad support weapon, the longer and heavier barrel optimizing the performance of the cartridge.

In the United States during the 1960s, the creative mind of firearms designer Eugene Stoner came up with the Stoner 63 modular weapons system. This ingenious weapon could be configured as a rifle, an LMG, or



The Stoner 63 weapon system, here in the hands of a US Navy SEAL in Vietnam, introduced the world to the concept of weapon modularity, and the possibilities of a 5.56mm belt-fed light machine gun (LMG). (US Navy)



an MMG depending on how its stock, feed system, and barrel were configured. Yet despite its tactical flexibility, the Stoner gun was at heart a 5.56mm weapon. In its LMG format, the gun used 75-, 100-, or 150-round disintegrating-link belts held in drum magazines, firing at a cyclical rate of 700–1,000rd/min. The Stoner was rather ahead of its time, however, and had its share of reliability issues. It was only issued in limited numbers, particularly to the US Navy SEALs, who developed an appreciation for the system during special operations in the Vietnam War. Furthermore, the Stoner was destined to be eclipsed by the Minimi.

It was during the 1970s that the 5.56mm LMG really took off, as a number of countries began design and production of such types. In 1974, CETME in Spain produced the belt-fed 5.56mm Ameli machine gun, which looked rather similar to a scaled-down German 7.92mm MG 42 general-purpose machine gun (GPMG) but which used a different delayed-blowback mechanism. Other 5.56mm LMG types that emerged during the 1970s and early 1980s were the Ultimax 100 from Singapore and the British SA80 Light Support Weapon (LSW, or L86A1). In 1974, however, the Belgian company Fabrique Nationale (FN) was beginning its journey into the field of 5.56mm LMGs. The legacy of that journey – the FN Minimi – would not emerge in earnest until volume production began in 1982; but when it did start to appear on the open market, it changed the face of infantry firepower.

A US Marine recruit familiarizes himself with firing the M249 SAW. The sloping forward grip is a more recent addition to the M249; this photo was taken in 2014. (USMC)



DEVELOPMENT

Ultimate one-man firepower

ORIGINS

By the time it began work on developing what would become the Minimi, FN was already a world leader in machine-gun design with its Mitailleuse d'Appui Général, or MAG, a 7.62mm GPMG workhorse in service from 1958. The MAG went on to achieve great international success, being adopted by more than 80 countries worldwide; but in the early 1970s the FN design team, led by Ernest Vervier (designer of the MAG) and one Maurice Bourlet, went to work on creating 5.56mm weapons. Their first offering was actually a rifle, the FN Carabine Automatique Légère (CAL), a 5.56mm version of the world-beating 7.62mm FN FAL battle rifle. (Interestingly, the SS109 cartridge developed for this rifle became the model for NATO standardization on the 5.56mm cartridge in 1977.) Their next objective, however, was to develop the gun that would become the Minimi.

It is worth considering some of the conceptual design parameters of this venture. An LMG has a particular set of design criteria that need to be fulfilled if the gun is going to function properly as an infantry weapon. First, it has to be configured to be operated by a single person. This is not just a consideration about weight and dimensions; it also has to address issues such as convenient ammunition feed – a single individual, for example, will struggle to operate a gun with a long, loose belt feed – and the degree to which ambidextrous controls are fitted. At a technical level, Vervier and Bourlet had to consider what would be the best type of operating system, i.e. one that would reliably deliver high rates of fire across the full spectrum of combat environments. The choice of barrel system was critically important. Some LMGs utilize fixed barrels, for simplicity of production and maintenance. Such weapons are, however, extremely limited in their sustained-fire capabilities, the barrels soon reaching critically high temperatures if the operator attempts to fire more



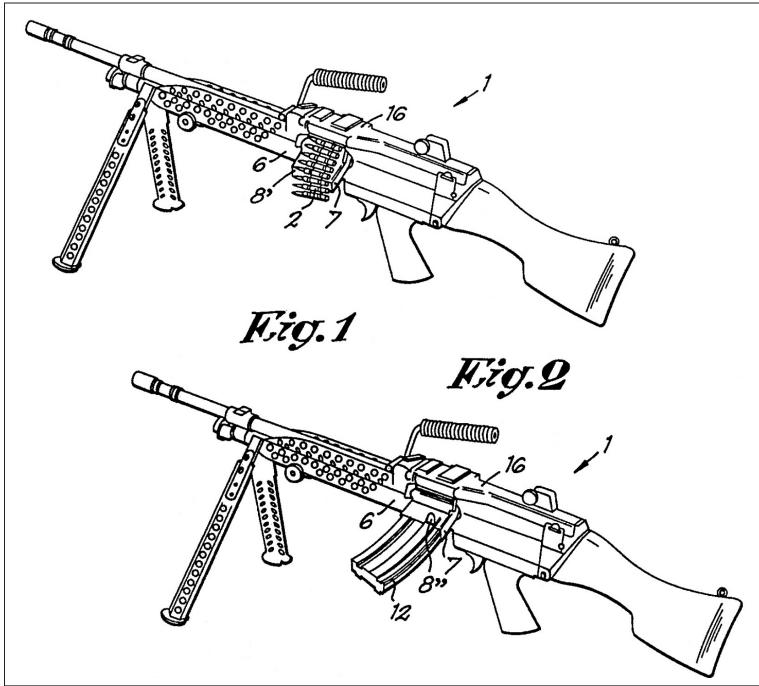
A belt of 5.56mm ammunition *in situ* in an FN Minimi. The green-tipped rounds are standard M855 ball rounds, interspersed with red-tipped M856 tracers. (USMC)

than 100rd/min as a practical rate of fire. So if the Minimi was to have a genuine sustained-fire role within the squad, a quick-change barrel would be a necessity. There was also the issue of mounts. Being an LMG, the Minimi would obviously require an integral bipod as its core platform; but to do full justice to its support roles, it would also need tripod and vehicular mount options. Most critically of all, it would have to convince the world that the 5.56mm cartridge was up to the job of serving as a front-line machine-gun round.

Details about the actual design and development process for the Minimi are scant. What we do know, however, is that it was a prolonged affair. Prototypes of the weapon emerged in 1974, but it would be another eight years before the gun finally achieved volume production and service adoption. FN was keen to get this gun right. In March 1972, the US Department of Defense (DoD) had issued a “material need” specification for a new Squad Automatic Weapon (SAW) for the US armed services. There were several weapons in the running, but the Americans were watching closely developments at FN. Vervier and his team, aware of the US interest, understood that their new gun had to impress the Americans



One of the early (c.1975) Minimis. At this stage in the development process the gun has yet to acquire the dual-feed mechanism for both belt and magazine. (From Smith & Ezell 1977)



This US patent diagram shows the early Minimi demonstrating its dual-feed proposition, switching between magazine feed and belt feed without mechanical modification by the user.
(FN Herstal/US Patent and Trademark Office)

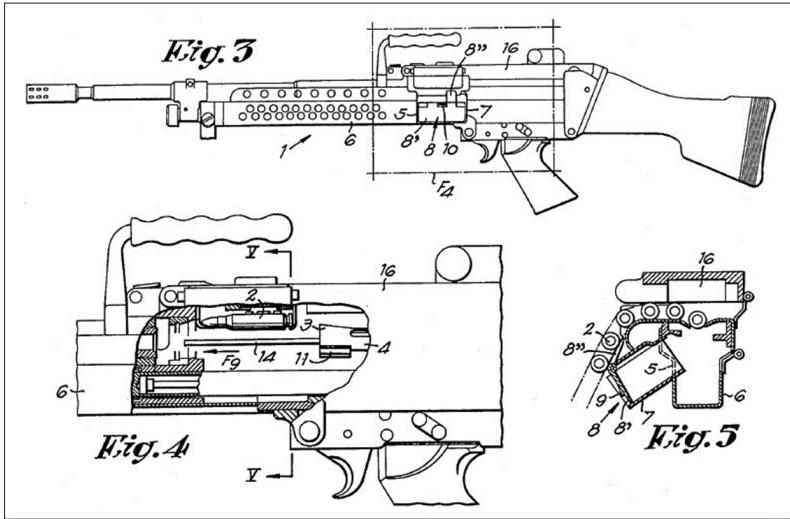
opposed to the 55-grain (0.13oz) bullet of the M193) gave better performance over range, and hence was more suitable for use in an LMG. The switch to the 5.56mm cartridge was highly significant, as it enabled FN to achieve the weight reductions necessary for a one-man weapon. Thus when the first gun emerged in late 1974, it weighed around 16lb; compare that with the MAG, at 26lb.

Looking at the early version of the Minimi, what is striking is just how much it actually looks like the MAG, though the MAG was just one of several design influences feeding into the new LMG. The Minimi prototype was, like the MAG, a gas-operated weapon, using a long-stroke piston system and three-lug rotary bolt locking, the latter similar to that used in the ever-reliable AK-47 mechanism. Firing was from an open bolt; the bolt was held back under return-spring pressure before pulling the trigger, a configuration that allowed more efficient cooling of the weapon under sustained-fire applications. The gas system also came with a regulator, so that the operator could increase the amount of gas flowing to the piston as inertia built up through gun fouling. The regulator had two settings – normal and “adverse” – the latter intended for use when the gun was getting dirty, although early operators noticed that it could also be used to increase the rate of fire when the gun was clean. Cyclical rate of fire was therefore 700–1,000rd/min. The charging handle (located on the right side) was independent of the bolt carrier, so it did not oscillate as the gun was fired – a feature that made the Minimi far more user friendly.

The new Minimi had a wooden buttstock and plastic pistol grip, plus a large ventilated forend section wrapping around the gas tube and most of the barrel. The use of ventilation holes was also mirrored in the bipod legs, as an aid to keeping the gun’s overall weight down. The barrel had a

if it was to access the largest market for military firearms in the world. (The circumstances surrounding the American adoption of the Minimi are discussed in detail below.)

It should be noted that when Vervier and his team first sat down to design a new LMG, they initially focused upon a 7.62mm NATO weapon, something akin to a slimmed-down version of the FN MAG; but attention was switched to the FN-developed 5.56mm SS109 round, as the SS109 with its 63-grain (0.14oz) bullet (as

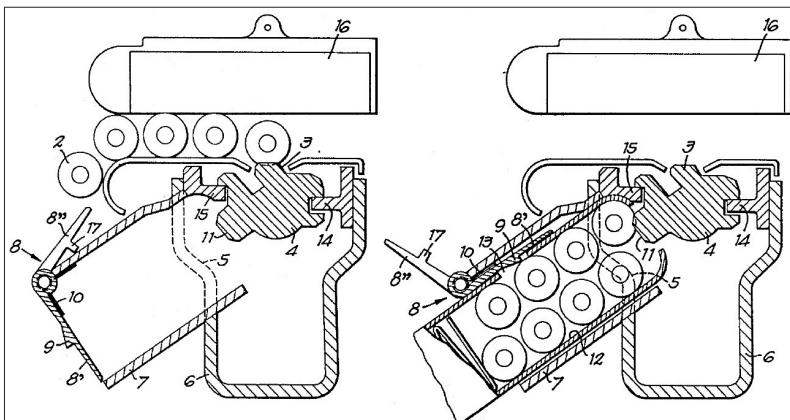


LEFT & BELOW More patent diagrams illustrating the Minimi feed mechanism. Note how the belt-feed mechanism is shut off when the magazine feed is in place. (FN Herstal/US Patent and Trademark Office)

quick-change system, actuated via a locking lever on the left side of the weapon. The barrel was an integral unit with the gas system, so both were detached during a barrel change. In terms of sights, the gun had a fixed front post plus a rear aperture sight fitted just forward of the feed tray hinge. The feed mechanism was a straightforward belt feed, inspired by that of the MAG (in turn inspired by that of the German MG 42 GPMG).

THE US INFLUENCE

Given the difference between this original Minimi and the Minimi that finally emerged during the 1980s, it is worth looking at some of the design influences that came to bear upon the weapon during the 1970s; and here we need to take a step back and look at what was happening in the United States at this time. In the late 1960s, the US Army began several studies into the composition and types of firepower available within its infantry units. Two of the studies, conducted by the US Army Training and Doctrine Command (TRADOC), concluded that to have greater tactical versatility, each infantry squad needed



to include two automatic gunners, one per fire team. This led to a Draft Material Need being approved in March 1972, for a new one-man machine gun that would serve as a “Squad Automatic Weapon” (SAW). The Minimi would be developed against the background of what became a competitive race to provide a new weapon to meet this need.

One of the first issues that the US ordnance authorities had to resolve was the caliber of the new weapon. Initially, it opted for a new 6×45mm cartridge, this being deemed to be intermediate between the standard 5.56mm round and the more powerful 7.62mm round. FN actually ignored this criterion during its initial development of the Minimi, largely because they saw that it didn’t make sense for the US armed services to increase further the range of required calibers. Eventually the US Army did shift its position, and opted sensibly for the 5.56mm. Thus from 1974, FN was in the race for the new US SAW, hence the Minimi reflected both Belgian innovation and US pressure to conform to its requirements.

At first, the Minimi was competing against three indigenous US designs from Maremont, Philco Ford, and Rodman Laboratory – given the US Army designations XM233, XM234, and XM235 respectively – plus Heckler & Koch’s HK23. FN kept up the innovations and improvements. By 1977, the Minimi had evolved more toward the LMG we know today. It featured a light skeleton stock. The ventilated heat shield was gone, replaced by a solid handguard, and the bipod was of a tubular, adjustable, and unventilated design. The barrel-change handle was slimmer, and the gun’s rear sights had shifted back along the top of the receiver to nearer the operator’s eye. The muzzle had received a modest redesign, featuring a simpler slotted muzzle brake as opposed to the longer ported version on the original gun. Most significant of all, however, was the fact that the gun now had a dual-feed mechanism, meaning that it not only accepted belt feed from belt boxes, but could also take standard 5.56mm rifle magazines. At first it only took 5.56mm FN FNC assault-rifle magazines, but later it was sensibly configured to take NATO STANAG magazines, as used in the M16 rifle. This feed system was designed by Maurice Bourlet, and a US patent (US 4112817 A 1977) was filed for the mechanism on April 18, 1977. The abstract for the patent read:

The invention pertains to a device for supplying portable arms by means of cartridge belts and by means of rifle magazines using the same ammunition, characterized by the fact that the weapon is provided with a lateral opening, extended by a sleeve which can serve the purpose of guide for a magazine, aforesaid sleeve being fitted with a flap which is conditioned in such a manner that it can close aforesaid sleeve and be used as guide for the cartridge belt, the bolt having two tenons, one of which is used to act upon the cartridges of a belt, one by one, and the other operating to act, one by one, upon the cartridges of a magazine. (US Patent US 4112817 A 1977)

The real ingenuity of the system was that when a belt was loaded, the magazine well was blocked, and when a magazine was fitted, the beltway was blocked. The fact that the user could switch between belt feed and



magazine feed without making any mechanical modification to the weapon gave the Minimi a huge advantage in the competitive trials in the United States.

The Minimi was starting to move toward its final shape. In April 1979 in the United States, testing began on four SAW candidates: the XM106 – essentially a heavy-barrel M16A1; the XM248 (a conversion of the XM235) made by Ford Aerospace Corp; the XM262 from Heckler & Koch; and finally the Minimi, known in the American tests as the XM249. At this point in time, the Minimi had been through numerous improvements since it first emerged in 1974. Its production qualities had been simplified with the US market in mind, the receiver being made from a single piece of steel, stamped and folded. There were improvements in the barrel-change system, and in the gun's furniture to suit some US tastes. (Note that there would be differences between the final European and US Minimis, but even with the requirements of the US SAW competition those differences were kept to a minimum.) Apart from the magazine-feed option, the XM249 also came with a hard-plastic 200-round belt box, meaning that the gunner could transport substantial amounts of ammunition around the battlefield.

The guns in the running for the SAW competition went through exhaustive testing. An article written for the January–February 1981 edition of *Army Research, Development & Acquisition Magazine* revealingly explains the onslaught each test weapon faced:

The weapons were subjected to 10 months of severe tests under all types of conditions: extremes of heat, cold, sand, dirt, mud, extended firing until barrels glowed red; and other tests to check reliability and safety ... General criteria called for: accuracy beyond M-16 capabilities; functioning without fail in extreme climates; a quick-change barrel which is replaceable in 10 seconds, even when hot; adaptability to night vision device use; being belt-fed but capable of accepting M-16 magazines for emergency use; the meeting of stringent technical requirements; have few moving parts; come with a self-contained cleaning kit; have a built-in bipod; be mountable in [sic] standard issue tripods; and be useable by soldiers wearing heavy winter gear, combat garb, and CBR suits ... "There were 54 criteria. No one gun met them all, but the Belgian entry met

A Minimi from the early 1980s. Some of the distinctive features of this particular weapon are the conical flash hider, the rather crude furniture, and the skeleton metal stock with shoulder piece.
© Royal Armouries PR.7442

more than the others. One of the important things about competitive testing is that features from other weapons can be incorporated into the final product,” Niewenhous noted [George Niewenhous, SAW test director for the Materiel Testing Directorate’s Small Arms and Automatic Weapons Branch]. Niewenhous stressed that the weapon was tested for endurance, parts interchangeability, accuracy, noise, smoke-flash signature, cook-off, and other types of things. Data were recorded for evaluation of maintenance, reliability, safety, and human factors. More than 600,000 rounds were also fired. (US Army 1981: 17)

As the arduous testing proceeded, the Minimi gradually emerged as the frontrunner, despite competing against designs such as the XM106, which was highly favored by the US Marine Corps. On May 28, 1980, an in-process review (IPR) was conducted to select the best SAW weapon from the four candidates. The IPR recommended the XM249 as the weapon that most closely satisfied the requirements for a SAW system, and the XM249 was duly chosen as the new SAW for the US armed services. The US government placed an order for 68,000 units, with the first 2,000 to be produced in Belgium but the remainder, from 1984, to be manufactured at a purpose-built FN plant in the United States.

THE MINIMI OPERATION

At this stage it is worth reminding ourselves that the story of the Minimi is not just an American story, but a global narrative. The interest in the Minimi rippled throughout the world, and as the 1990s dawned, international orders came flooding in.

The basic principles of the Minimi have already been described, but examination of the gun’s operating cycle in a little more technical detail is required to understand fully the gun’s qualities. The firing cycle of the Minimi begins when the gun is loaded, either by placing the first round of the ammunition belt in the feed tray groove (accessed by opening the feed tray cover), or by inserting a magazine into the magazine well. The gun is then cocked using the charging handle; pulling the handle back draws the bolt carrier and piston rod to the rear, holding the bolt back against the pressure of the return spring through engagement between the trigger sear and the sear notch in the bolt. When the operator flicks off the cross-bolt safety and pulls the trigger, the sear drops and allows the bolt to be released forward by the power of the return spring. At the same time, as the US Army’s M249 manual explains:

the feed lever is forced to the right, causing the feed-pawl assembly to turn in the opposite direction. This forces the feed-pawl assembly over the next round in the belt, and the feed-pawl assembly is ready to place the next round into the tray groove when the rearward action occurs again. As the bolt moves to the rear after firing, the feed roller forces the feed lever to the left. The feed lever is forced to turn, moving the feed pawl to the right. This places a round in the tray groove. (US Army 2003: 1-28)



A US Marine with Bravo Company, Infantry Training Battalion (ITB), School of Infantry-East, fires an M249 during a live-fire exercise at MCAS New River, North Carolina, the last rounds running in from the belt. (USMC)

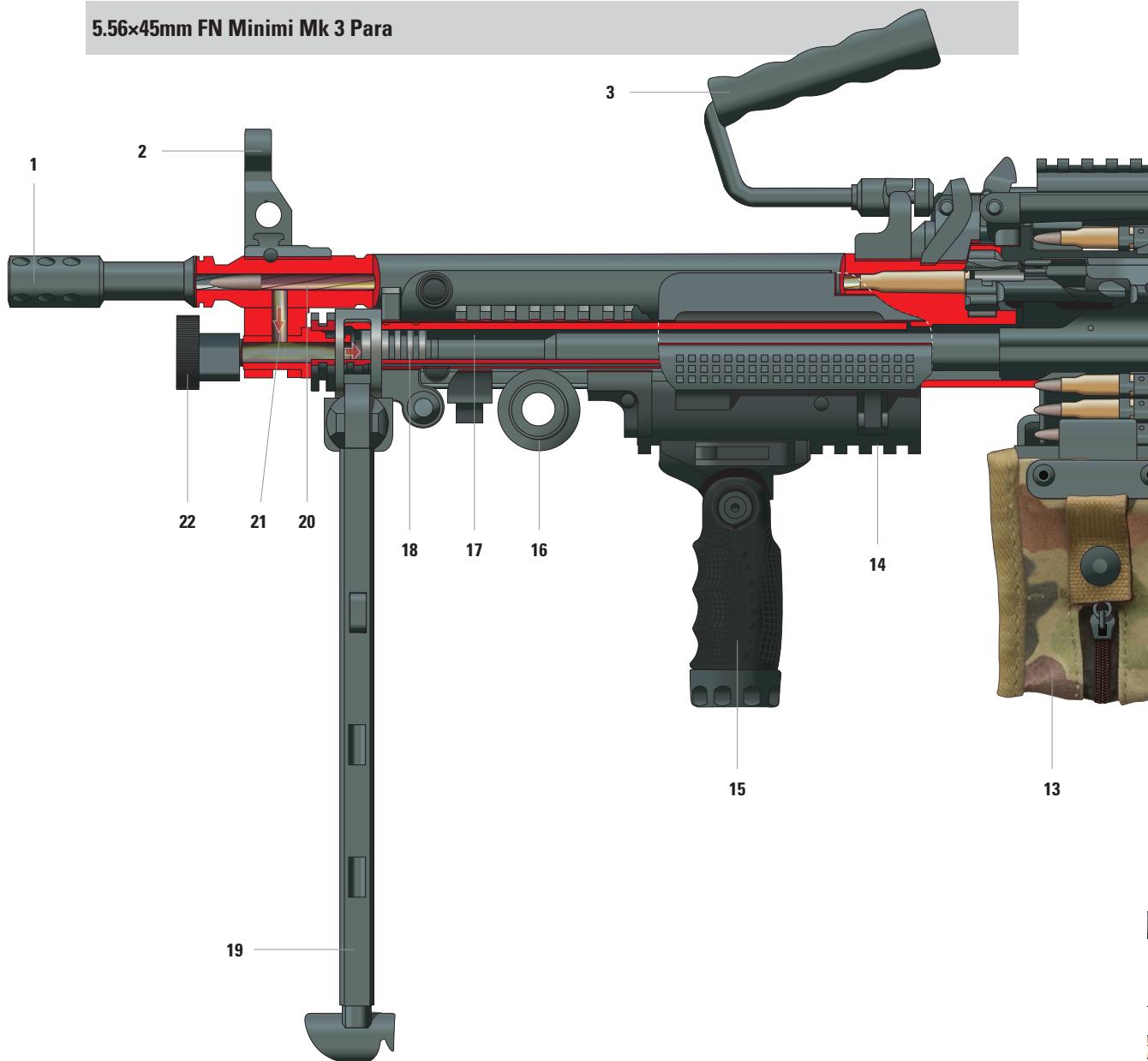
Returning to the action of the bolt, as it goes forward the upper stripping lug catches the rim of the first cartridge, stripping it from the belt; the bolt then drives the cartridge forward over a chambering ramp and into the chamber. As the round is seated in the chamber, the bolt enters the barrel extension, and the upper and lower locking lugs on the bolt come into contact with camming surfaces on the extension and rotate the bolt clockwise by 90° in the barrel extension. The bolt is now locked solidly in place, and the extractor locks over the rim of the cartridge. The ejector inside the receiver is pushed down. At this point the piston assembly, which carries the firing pin through the bolt, keeps going forward for a short distance, driving the firing pin onto the cartridge primer and firing the round.

The bullet now travels down the barrel, driven by the expanding propellant gases behind it. As it passes the gas port near the muzzle, a portion of the gas is directed through the port and into the gas cylinder, pressing on the piston head and driving the piston – and hence the bolt assembly – rearward. During the rearward movement the bolt hold again engages with the camming surfaces and this time rotates the bolt 90° counterclockwise, unlocking the bolt from the barrel extension. The bolt rotation loosens the cartridge case in the chamber, and as the bolt disengages from the barrel extension the extractor draws the spent case from the chamber. As the bolt passes the ejector, the ejector clip flicks outward, pushing on the spent case which is eventually thrown from the gun via the ejection port. Note that at the same time, if the weapon is using belt feed, the empty belt links are expelled out of the link ejection port on the side of the receiver as the rearward motion of the bolt moves the next round into position in the tray groove.

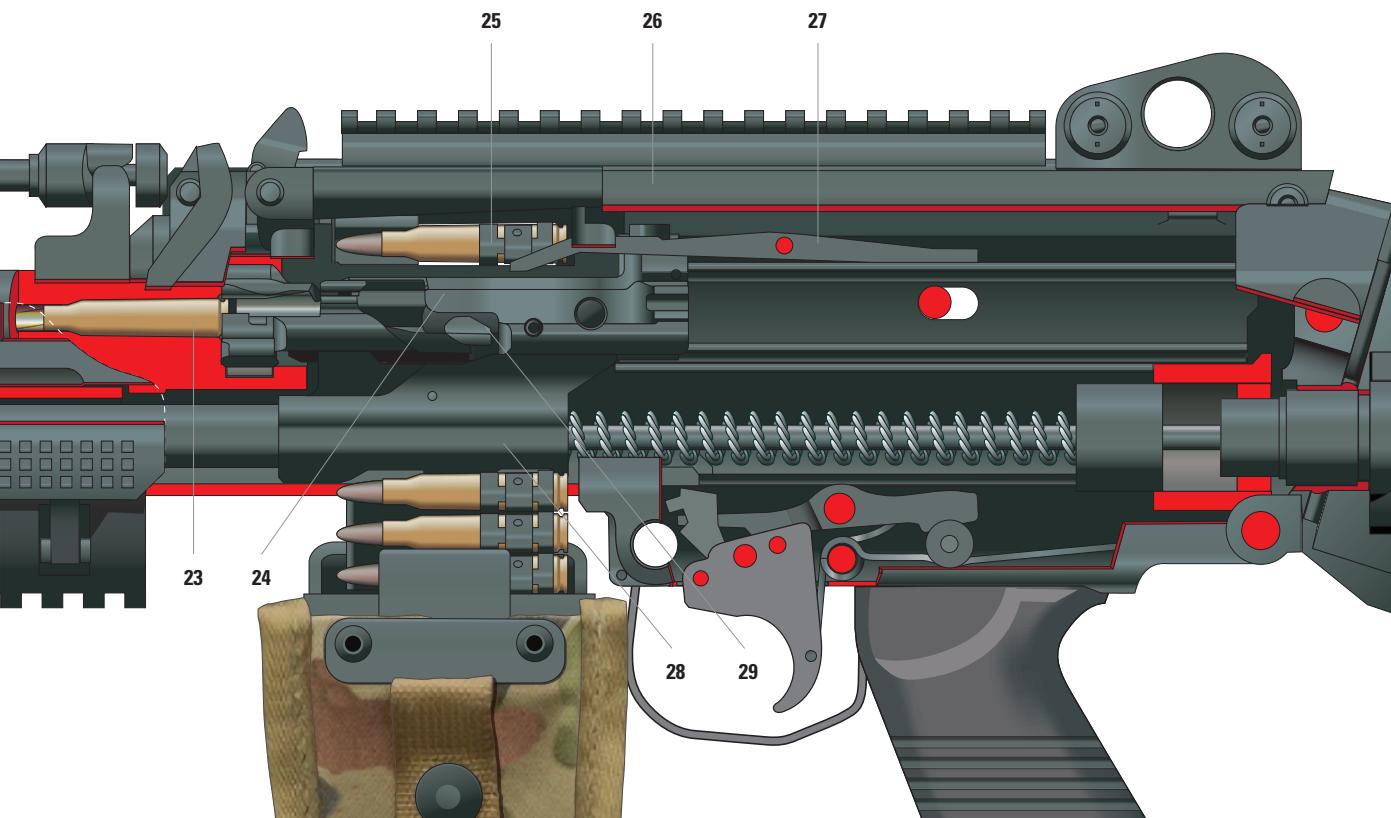
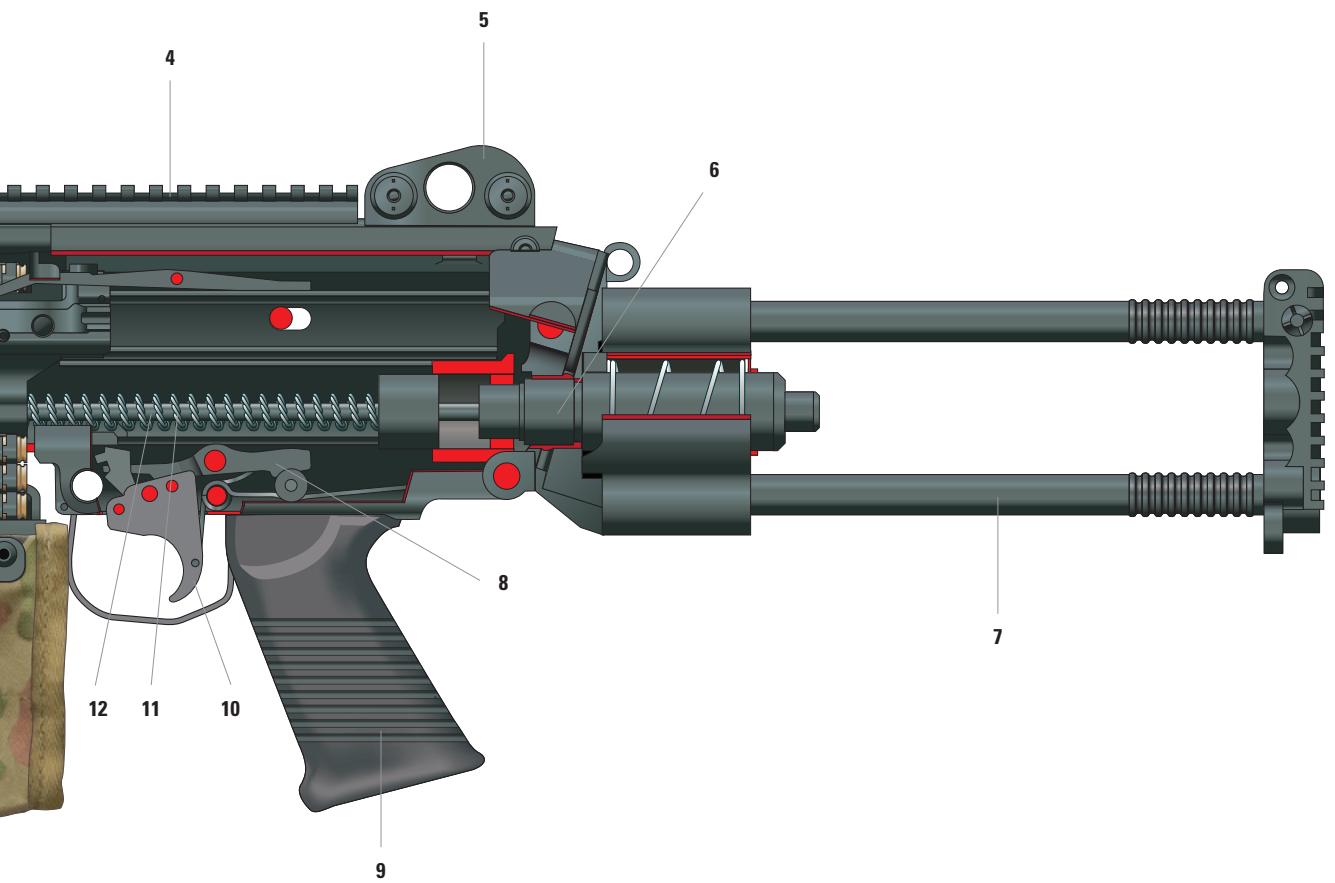
The bolt and piston are driven by gas pressure to the rear of the gun, to the original cocked position, against the building inertia of the recoil spring. If the operator keeps his finger on the trigger, the gun will repeat the cycle automatically once it reaches its final extent, resulting in full-automatic fire. When the trigger is released, however, the sear again engages with the sear notch, stopping the forward motion of the bolt and holding the bolt once again in the cocked position, ready for firing.

THE MINIMI EXPOSED

5.56x45mm FN Minimi Mk 3 Para



- 1. Flash hider
- 2. Front sight
- 3. Carry/barrel-change handle
- 4. Tactical rail
- 5. Rear aperture sight
- 6. Buffer assembly
- 7. Collapsible buttstock
- 8. Sear
- 9. Pistol grip
- 10. Trigger
- 11. Operating-rod spring
- 12. Operating rod
- 13. Ammunition belt pouch
- 14. Forward handguard tactical rail
- 15. Forward tactical grip
- 16. Tripod/mount aperture
- 17. Gas cylinder
- 18. Gas piston
- 19. Adjustable bipod
- 20. Barrel
- 21. Gas port
- 22. Gas regulator
- 23. Chamber (with cartridge case *in situ*)
- 24. Bolt group
- 25. Ammunition belt
- 26. Top cover
- 27. Feed pawls
- 28. Piston assembly
- 29. Bolt camming lug



FN VARIANTS

The Minimi operating mechanism is the beating heart of the weapon, regardless of the variant. As for Minimi variants, there have been many – hardly surprising given that the Minimi has been adopted by more than 75 countries and is license-built in Australia, Italy, Indonesia, Japan, Sweden, and Greece. Furthermore, it is also produced in several countries without license, notably China, Taiwan, and Egypt.

Looking at the core FN-produced weapons, the Minimi family essentially divides itself into two models – the standard gun plus the “Paratrooper” or “Para” variant – basically distinguished by barrel length and stock configuration. Thus the “Standard” Minimi model has a barrel length of 18.3in and a skeleton aluminum stock with a folding wire shoulder strap. Note that all Minimi models can have their metal skeleton stocks replaced with fixed synthetic versions, the latter stocks containing a hydraulic buffer to give the weapon a more constant rate of fire and help reduce recoil forces. The “Para” model is, as its name suggests, an even more compact version designed for use by airborne troops or by soldiers who need to carry the weapon within the confines of an armored vehicle. To accomplish this, the barrel length has been reduced to a squat 13.7in; and a collapsible metal stock is fitted. The change in barrel length has had a moderate impact upon the Para version’s muzzle velocity. Whereas the standard model fires the 5.56mm round at 3,035ft/sec, the Para’s velocity is 2,840ft/sec, reducing the maximum effective range from around 1,000m (1,090yd) to 600–800m (656–875yd), although achieving this range can to a large degree depend upon the skill of the gunner. Note that the barrels themselves feature a chrome-lined bore with right-hand rifling at a rate of 1:7 for the SS109 or 1:12 for the M193 or M855 ammunition.

In terms of the sights, the Minimi comes as standard with two iron sights. Both sights are adjustable for elevation and windage; the rear sight is an aperture type, and is adjustable for ranges from 100m (109yd) to 1,000m (1,094yd) in 100m increments. However, the Minimi can also be fitted with a variety of optical sights, and these will be covered in more detail in the Use chapter.

In the early 2000s, responding to a requirement issued the US Special Operations Command (USSOCOM) for a replacement for the 7.62mm M60E4, FN also began to produce the Minimi in 7.62mm NATO caliber. Although the layout of the gun remained essentially the same, the adjustments to the operating mechanism meant that whereas the standard 5.56mm weapon had a rate of fire of between 700 and 1,150rd/min, the 7.62mm version had a maximum rate of 800rd/min. The slower rate of fire was necessary both for fire control (the 7.62mm naturally imparts a heavier recoil) and ammunition consumption, the 7.62mm operator being able to carry less ammunition than if he was handling 5.56mm rounds.

Another major evolution in the Minimi series came in November 2013, when FN unveiled the **Mk 3** series of guns, which incorporated feedback from the previous 10–15 years of operational use in various theaters. The changes incorporated in both the 5.56mm and 7.62mm version are as follows (note that some are optional).



First, an ergonomic tubular buttstock is fitted, designed to have an improved shoulder mount for those wearing body armor or bulky load-bearing equipment. To fit to the person, the stock can be adjusted for length through five positions; an adjustable section on top of the stock means that the gun can also be adjusted for cheek weld, to ensure a highly consistent mount onto the sights, whatever configuration they are. The buttstock also includes a folding shoulder rest plus the rate-of-fire and recoil benefits of a hydraulic buffer system.

Second, the furniture forward of the stock has also been redesigned. The Mk 3 has three forward MIL-STD 1913 Picatinny accessory rails set around the redesigned forward handguard. The rails allow the mounting

Latvia has been one of the many countries to adopt the Minimi, as exemplified by this Latvian Army soldier armed with the standard Minimi model set on a vehicle mount. (Latvian Army CC-BY-2.0)



A Minimi Para on display with what appears to be a large thermal-imaging scope offset on a bracket attached to the receiver. The gun is fitted with the 100-round hard plastic magazine. (Pistoufinaire CC-BY-SA-3.0)



This French Minimi, used by soldiers of the French Foreign Legion, is shown with a spare barrel, which is complete with gas port, carrying handle, and front sights. (davric CC-BY-SA-3.0)

of a variety of accessories around the front of the gun, such as a front grip, tactical lights, or laser rangefinder/aiming devices. The three-height adjustable bipod has also been redesigned, so that even if the gunner has accessories fitted to the rails, the bipod can still be folded back and locked into place either side of the handguard.

Third, the Mk 3 comes with an optional heat shield, which can be fitted over the barrel to protect the user's hand.

Fourth, the cocking handle has been the subject of an ergonomic redesign, giving it improved grip qualities so that it can be cocked by either hand. (This feature is useful if the gunner has to work the gun from a position that necessitates cocking with his weak hand.) It also features an automatic and integral locking catch to ensure that the handle stays forward and static when the gun is firing.

Finally, an important modification is the improvement of the feed tray, with the fitting of belt-retaining pawls to hold the belt in position during the one-man loading procedure, especially when having to do so in awkward standing positions.

The Mk 3 is available in both 5.56mm and 7.62mm, and each of the calibers falls into the same four subvariants. There is the standard long-barrel weapon, with the fixed synthetic stock, plus the Para version with the tubular aluminum extending stock. Then there are two "tactical" variants with the new five-position stock: the "SB" short-barrel version and the "LB" long-barrel version. Feed for the 5.56mm version is either from a loose belt, a 200-round box, a 100- or 200-round pouch, or 30-round magazines. The Mk 3 will doubtless keep the Minimi relevant in the market place for many years to come, and it is already attracting many buyers.

THE M249

By far the most significant variant of the Minimi is the **M249 Squad Automatic Weapon**. Although the M249 is an FN product, its evolution through FN USA took some slightly different twists and turns compared to the European models. Early in the adoption of the M249, the US Army began implementing a variety of changes in what it termed its Product Improvement Program (PIP). Many of the changes were ergonomic in focus: some of the gun's sharp edges were beveled or chamfered to prevent cuts on sharp edges; a handguard was added to prevent burns from a hot barrel; the fixed carrying handle was redesigned as a folding unit; and there were other adjustments to the bipod, pistol grip, flash suppressor,

M249 Data – US Field Manual FM 3-22.68

Ammunition	5.56-mm ball and tracer (4:1 mix) ammunition is packaged in 200-round drums, each weighing 6.92 pounds; other types of ammunition available are ball, tracer, blank, and dummy.
Tracer burnout	900 meters [984yd] (+)
Length of M249	40.87 inches
Weight of M249	16.41 pounds
Weight of tripod mount M122 with traversing and elevating mechanism and pintle	16 pounds
Maximum range	3,600 meters [3,937yd]
Maximum effective range	1,000 meters [1,094yd] with the tripod and T&E
Area:	
Tripod	1,000 meters [1,094yd]
Bipod	800 meters [875yd]
Point:	
Tripod	800 meters [875yd]
Bipod	600 meters [656yd]
Suppression	1,000 meters [1,094yd]
Maximum extent of grazing fire obtainable over uniformly sloping terrain	600 meters [656yd]
Height of M249 on tripod mount M122A1	16 inches
Rates of Fire:	
Sustained	100 rounds per minute. Fired in 6- to 9-round bursts with 4 to 5 seconds between bursts (change barrel every 10 minutes)
Rapid	200 rounds per minute. Fired in 6- to 9-round bursts 2 to 3 seconds between bursts (change barrel every 2 minutes)
Cyclic	650 to 850 rounds per minute. Continuous burst (change barrel every minute)
Basic load, ammunition	1,000 rounds (in 200-round drums)
Elevation, tripod controlled	+200 mils
Elevation, tripod free	+445 mils
Depression, tripod controlled	-200 mils
Depression, tripod free	-445 mils
Traverse, controlled by traversing and elevating mechanism	100 mils
Normal sector of fire (with tripod)	875 mils

(US Army 2003: 1-2)

The M249 SAW, as seen in its configuration at the end of the 1990s, hence the absence of the protective shield over the top of the barrel. (USMC)



An M249 Para model in 2010, having been through extensive stages of improvement. An ergonomically improved pistol grip has been attached to the mounting rail beneath the handguard, and the gun is fed from a 100-round soft pack. (US Army)

and sights. A significant change was the replacement of the tubular steel stock with an M240-style synthetic stock, plus the fitting of a hydraulic buffer system to reduce recoil. At the front of the gun, the US armed forces opted for a single gas setting, meaning that the M249 could not be adjusted to deliver higher rates of fire. Further changes came with other modification programs, such as the Soldier Enhancement Program and Rapid Fielding Initiative. The three most significant changes from these programs were an improved bipod, which delivered better stability and therefore weapon accuracy; the introduction in 2008 of 200-round soft packs to replace the hard-plastic ammunition containers (the gun could still take the STANAG magazines in emergencies); and the fitting of Picatinny rails to the feed tray cover and forearm, to provide more options for the fitting of accessories. All of these upgrades were in place by 2010.





In addition to the PIP variants, the M249 also comes in a shortened Para version, including a new buttstock similar to that of the M4 Carbine; and the M249 Special Purpose Weapon (SPW), announced by FN in 1996, which is a compact and lightweight variant. Also known as the **M249E4**, the SPW has a lightweight barrel, but the carrying handle, vehicle mounting lug, and magazine insertion well have all been removed, further lightening the load. The bipod and front grip are also detachable, the butt is retractable, and instead of a handguard the gun has three MIL-STD-1913 rail interfaces around the forend, plus another on the feed cover. The SPW in turn led to the **Mk 46 Mod 0** in 2000, essentially an improved SPW developed for use by USSOCOM. The principal differences between the SPW and the Mk 46 Mod 0 are that the latter has a heavier fluted barrel for better accuracy and heat management, an additional front rail in the 12 o'clock position, and a lighter fixed plastic stock. It also dispenses with the magazine port, to reduce weight. Note that in 2006 a contract between the United States Naval Special Warfare Command, Crane Division (NSWC Crane), and FN Manufacturing, Inc., resulted in the refurbishing of Mk 46 Mod 0 guns to a new standard, designated as **Mk 46 Mod 1**, featuring an improved bipod assembly plus the fitting of the traditional top heat shield instead of the 12 o'clock position front rail.

One particularly interesting development of the M249 came in the early 2000s, when USSOCOM issued a requirement for a new LMG to replace the M60E4/Mk 43 Mod 0 then in use with the NSWC. The design chosen was the **Mk 48 Mod 0**, which is in essence an M249 but recalibrated for the 7.62×51mm NATO cartridge. An updated version, the **Mk 48 Mod 1**, was subsequently issued with a different barrel length. The Mk 48 weapons can be configured with various rails, grips, and buttstocks in much the same way as the M249. Rate of fire for the Mk 48 weapons is 650–710rd/min; they are largely used by the US Navy SEALs and US Army Rangers.

The 7.62mm Mk 48 Mod 0/1 Lightweight Machine Gun; an evolution of the Minimi that reflects the theater demands for a heavier-caliber weapon.
(US Army)

This Canadian soldier with 1st Battalion, Princess Patricia's Canadian Light Infantry is armed with a C9A1 (one of the two Canadian versions of the Minimi) fitted with a blank-firing adaptor on the muzzle. (US Navy)



OTHER VARIANTS

Adoption of the Minimi has been notably extensive on the international scene, and only a handful of the international variants and designations can be noted here. The British Army adopted both the Standard and Para versions during the early stages of the war in Iraq in 2004 (although there was some earlier use by British Special Forces in the 1990s), with the designations L108A1 and L110A1 respectively. Based on combat experience gleaned in both Iraq and Afghanistan, the British later introduced the L110A2 variant of the Para weapon, featuring a mounting rail on the feed cover and further rails around the forearm. The top-mounted rail fittings allow the fitting of standard British optical sights, such as the Sight Unit Small Arms Trilux (SUSAT).

Within the British Commonwealth, both Australia and Canada have also adopted the Minimi as their standard squad infantry weapon. In Australian service it is designated as the F89, and again both Standard and Para versions are used, the latter usually having a removable forward grip and a detachable bipod. The Australian forces also use a 7.62mm variant, known catchily as the **Maximi**. In Canadian forces, the embrace of the Minimi has been wholehearted. The basic version is the C9, essentially a standard Minimi with the tubular steel stock. There are two other versions: the C9A1, which has a Picatinny rail on the feed cover for the mounting of a 3.4x ELCAN C79 telescopic sight, plus a vertical grip beneath the stock to aid stability in the firing position; and the C9A2, which features a low infrared signature (through the material development of the gun furniture), a foldable and extendable four-position butt, a cover with a longer rail mount and adjustable rear sight assembly, and a short barrel assembly with folding handle.

The list of international variants and designations could run to several pages. What is important to note, however, is that the fundamental operating system of the Minimi is ideally suited to the adaptation of the furniture, accessories, and layout of the gun according to the needs of the user; and it is to their needs that we will now turn.



USE

Combat and controversy

This chapter on the use of the Minimi in action begins with a deceptively simple question: what is the Minimi for? It is not easy to provide an answer that satisfies all parties, for any change in the composition of infantry firepower generates much argument – and the Minimi is no exception.

TACTICAL ROLE

A starting point for this discussion is a report written by the US Army's Task Force Devil Combined Arms Assessment Team (Devil CAAT), entitled *The Modern Warrior's Combat Load Dismounted Operations in Afghanistan April–May 2003*. This lengthy document comprises a study of the physical items dismounted US infantry carry into combat, specifically within the context of Operation *Enduring Freedom III*. To provide context to the information about the material burden of the M249 gunner, the report's authors also provide one of the most succinct tactical summaries of the Minimi in general:

10.1.1.5 The Squad Automatic Rifleman

Description:

The Squad Automatic Rifleman serves a key role within each Fire Team of a Rifle Squad as he employs the squad's most casualty producing weapons system. The M249 Squad Automatic Weapon is the only fully automatic weapon in the Rifle Squad. There is one Squad Automatic Riflemen within each Infantry Rifle Squad Fire Team. As a member of the Fire Team, the Squad Automatic Rifleman provides security within his assigned sector and engages targets of opportunity with automatic fires as directed by the Fire Team Leader. Additionally the Squad

During an action in Kandahar Province, Afghanistan, a US Army M249 gunner takes sighting instructions from his team leader, opting to use his bag (rather than the integral bipod) as a front support. (US Army)



Automatic Rifleman is capable of providing overwatch and suppressive fires in support of team, squad, and platoon movement and assault. The Squad Automatic Rifleman is often called upon to provide overwatching fires for special teams, such as breaching, demolition, aid and litter, personnel under custody (PUC) search and control, and anti-armor/bunker teams. The Squad Automatic Rifleman carries the M249 Squad Automatic Weapon.

Common Tactical Tasks:

- Moves as a member of a Fire Team.
- Engages targets with direct automatic fires.
- Provides target suppression.
- Provides overwatch while obstacles are breached.
- Enters and clears a room, hallway, stairwell as a member of a Fire Team.
- Enters and clears caves, tunnels, and man-made fortifications.
- Breaches and/or bypasses obstacles.
- Performs Security Checkpoint Operations as a member of a Fire Team.
- Searches personnel under custody.

(Devil CAAT 2003: 22–23)

Boiling this description down to its essential principles, the Minimi/M249 hangs its hat on two main qualities: mobility and firepower. The mobility aspect is that the Minimi is portable enough in its weight and dimensions, and also in its ammunition, for a single soldier to carry it virtually in the same manner as a standard assault rifle. Some comparative specifications are useful here to illustrate this point. The standard M16A2 assault rifle weighs in at 7.5lb and has an overall length of 39.6in. If we jump upward a couple of levels of firepower, we arrive at the FN MAG/M240 GPMG, a weapon with a near-unrivaled positive reputation. Looking at the M240B specifically, the gun alone weighs 27.5lb, with an overall length of 50.9in. The heavy weight and the long length, plus the extra burden of the ammunition, spare barrels, and, if required, the tripod mount, make it clear

why the MAG is a team-supported weapon, best used when firing from static positions or vehicular mounts. The Minimi sits neatly between these two poles: it weighs 15.1lb and the length of the Standard model is 40.9in. In the case of the Para model, the length with the stock collapsed drops to even less than weapons such as the M16A1 rifle – 30.2in – with a weight fractionally less than that of the Standard model (14.5lb). As for length, the Para model even challenges the compact M4 Carbine, which is 33.0in with the stock extended and 29.8in with the stock collapsed. (Note that the specifications of the Minimi change according to the variant. The Mk 3, for example, is stated as weighing 17.6lb on the FN website.)

The dimensions and weight of the Minimi are the principal reasons why the operator of the gun is able to enter and clear “a room, hallway, stairwell as a member of a Fire Team.” The standard width of a doorway is roughly 32in – in some formats the Minimi could actually pass through such an aperture sideways on. Even if the gun is not thus configured, it is still small enough to be able to be maneuvered comfortably around the interior spaces of a building; and light enough to have a certain degree of tactical mobility, including being able to mount the gun to the shoulder, at least for short periods of time, and to maintain this position on the move with the gun at the ready. Try doing that with a MAG.

Of course, it would be erroneous to give the impression that the Minimi is a featherweight weapon that virtually floats itself around the battlefield. The Devil CAAT report quoted above notes that the average mission duration in Afghanistan was 48–72 hours; carry or handle any weapon that weighs around 15lb for that length of time, even with rest periods, and the muscular strain is likely to be intense. Furthermore, the gun always has to be considered in the context of all the other uniform and kit worn or carried by the soldier. When listing the “Equipment Common to Squad Automatic Weapon Gunners,” just the “Fighting Load” (the essential kit items carried for mobile combat) includes:



The Minimi Para is ideal for handling in the confines of military vehicles; here a Para-armed Dutch soldier climbs out of the back of an armored personnel carrier. (P.J.L Laurens CC-BY-3.0)



A US soldier of the 1st Platoon, Regimental Troops Squadron, 278th Armored Cavalry Regiment, Tennessee Army National Guard, demonstrates shoulder-firing the M249 SAW. (US National Guard)



A Canadian soldier trains with his C9A1, which is fitted with a blank-firing adaptor designed to increase gas pressure to levels sufficient to cycle the weapon.
(US Government)

night vision mounting plate.

- Rigger belt.
- Notebook and pen.
- Watch.
- Knee and elbow pads.
- Sun, Sand, and Dust type Goggles or Wiley-X Goggles.
- Folding Knife/Multi-tool.

B. Worn on Fighting Load Carrier/Interceptor Body Armor:

- MOLLE Fighting Load Carrier with modular MOLLE pouches.
- M249 Spare Barrel Bag.
- Bayonet.
- Fragmentation grenade.
- 64 ounces of water in two 1-quart canteens.
- 100 ounces of water in a hydration bladder.
- Casualty and witness cards.
- Flex cuffs for personnel under custody.
- Night vision equipment (PVS-14/PVS-7).
- Iodine tablets.
- Lensatic compass.
- Flashlight.
- Chemlight.
- First Aid dressing and pouch.
- Canteen Cup.
- Earplugs.

(Devil CAAT 2003: 10–11)

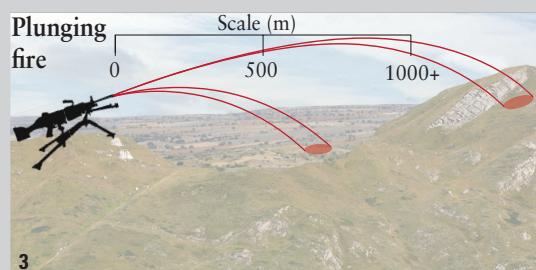
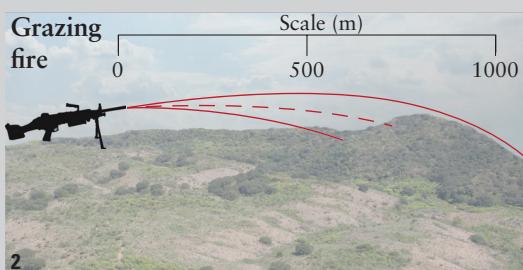
This list is just the beginning. The report goes on to itemize three other sections of kit – Carried in Assault Rucksack, Carried in Main Rucksack, and Special Equipment – each of multiple items, and including for the SAW “700 rounds of 5.56mm linked ammunition,” “M249 SAW Cleaning Kit,” and “M249 Spare Barrel Bag.” Thus the report’s authors concluded that the average fighting load – the lightest configuration of kit – was

MINIMI FIRE CHARACTERISTICS



Although the Minimi does not have the same long-range fire capabilities of a 7.62mm or .50-caliber machine gun, it can still be handled in both direct- and indirect-fire modes. The chief objective of a machine-gunner is to place as much of the target area within the “beaten zone” (1) of the gun; the beaten zone is an elliptical pattern of bullet impacts on the ground or target. The main image here shows an M249 gunner aligning his gun to play his beaten zone along the path of a linear group of enemy infantry. Moving the gun through traverse and elevation will spread the beaten zone wider and longer to trap those trying to escape it. The profile of the beaten zone also changes significantly according to the rise and fall of the terrain

and to the elevation applied to the gun. In “grazing fire” (2) the cone of fire does not rise above 1m from the ground, which in the case of the Minimi means that anything taller than 1m will be in danger across a range of about 600m (the range at which the bullets fall to earth). The beaten zone for grazing fire is long compared to that “plunging fire,” (3) in which the high elevation of the gun, or the nature of the terrain, means that the bullets fly high over the ground, the only point of danger for the enemy being the rounded beaten zone created by the steeply dropping bullets. With the Minimi, plunging fire can be delivered out to ranges in excess of 1,000m.



79.08lb (44.74 percent of the average user's bodyweight), while at its most extreme the kit weight was 140.36lb (79.56 percent of bodyweight). So while the Minimi is definitely a light machine gun, it still requires a user with sufficient muscle power and endurance to handle it. As we shall see, its weight has given rise to some tactical complaints.

The other defining characteristic of the Minimi is its firepower. Machine guns such as the MAG and, on a heavier scale, the .50-caliber Browning M2HB, are designed for long-range attrition and material destruction. For example, a MAG could make a respectable mess of a reinforced infantry position at ranges in excess of 1,500m (1,640yd). The Minimi would struggle at such a range, not only in terms of the arc of fire but also in the power drop-off of the 5.56mm round, which is more significant over longer ranges than that of the 7.62mm round. Indeed, the comparative firepower capabilities of individual rounds exiting the barrel of the Minimi are actually little different to those exiting an assault rifle or carbine. To take a British example, the 5.56mm SA80A2 IW (Infantry Weapon), also known as the L85A2 – the standard rifle of the British armed services – has a barrel length of 20.4in to deliver a muzzle velocity of 3,050ft/sec and an effective range of between 300m (328yd) and 600m (656yd), depending on the sighting options used. The Standard Minimi has a barrel length of 18.3in and a muzzle velocity of 3,035ft/sec, both figures actually inferior to those of the SA80A2. However, the more stable platform of the Minimi (bipod, tripod or vehicular mount), and its sighting options, actually extend its maximum effective range out to 1,000m (1,094yd). Yet arguably, given the fact that modern assault rifles are also full-automatic weapons (or at least with a three-round burst capability), the firepower distinctions between assault rifles and the Minimi might appear slight.

To draw such a conclusion is to ignore two critically important factors: ammunition feed and sustained-fire capability. An M4-armed rifleman with typical fighting load would have a 30-round magazine in his assault weapon, plus about another 180 rounds of magazine-loaded ammunition in his assault pack, giving him a grand total of 210 rounds. The practical rate of fire for the M4 Carbine is in the region of 30–100rd/min, with the top end of that scale starting to climb a little high, thus running the risk of the weapon overheating while also creating problems associated with using up 50 percent of the soldier's total ammunition in just a minute's-worth of mad firing. Given the limitations on the practical rate of fire, even the three M4-armed soldiers in a typical US Army fire team have a restricted capability for delivering suppressive fire.

Here is where the Minimi fills the gap in the firepower equation. The SAW/Minimi operator will typically have a weapon fitted with a 100- or 200-round belt (depending on the ammunition feed format chosen), with about another 700 rounds of linked ammunition in his assault rucksack, for a total of up to 900 rounds. Furthermore, in many infantry fire teams one of the riflemen might also carry some spare ammunition for the Minimi – typically about 200 rounds – for use in an emergency, taking the total stock of SAW ammunition up to 1,000 rounds. Viewed from this perspective, a single SAW gunner might have five times the ammunition volume compared to the regular infantrymen. He can also, by virtue of the



Minimi's barrel-change facility, put those rounds downrange with a greater rate of fire. Although the cyclical rate of fire of the Minimi is up to 1,150rd/min (with the adjustable gas settings), its practical rate is more in the region of 200rd/min, based on a barrel change every two minutes. If the gunner wants to avoid a barrel change, he needs to keep the rate of fire around 85rd/min – but that can be sustained for a long period, unlike the carbine or rifle, because of the heavier barrel and the greater supply of ammunition. Thus the Minimi, unlike the standard rifle, has the capability to deliver proper suppressive fire during an infantry assault, as well as proper overwatch duties and light obstacle breaching.

The combination of firepower and mobility means that the Minimi essentially occupies two positions in the hierarchy of firearms. First, it is an LMG, capable of suppression, attrition, and destruction at medium to long ranges. Second, it is a form of infantry automatic rifle in the tradition of the Browning Automatic Rifle (BAR), being light enough to be carried in the assault but with an augmented capacity to deliver firepower when required.

There is much controversy and argument surrounding the role of the Minimi in the armed forces, particularly in the United States and especially in the context of the SAW's role as an automatic rifle. We will look at those arguments in more detail in the "Impact" section. For now, however, we delve more deeply into the functionality and firepower of the Minimi in action.

US Army soldiers, one of them armed with an M249 Para, enter a building believed to be storing illegal weapons during a combat raid in Zurmat, Afghanistan, on October 16, 2004. (US DoD)

MOUNTS, SIGHTS, AND ACCESSORIES

If the Minimi's firepower characteristics are defined by its mounts and its sights, rather than its intrinsic ballistics, those systems are worth some deeper consideration. Space precludes an exhaustive assessment of all these systems, and in all their national variations, but we can look at the core types of technology available, starting with the subject of mounts.

The Minimi's standard mount is its integral bipod, which is fitted around the gas cylinder group; when the gas cylinder is removed the bipod can also be detached. In the modern forms, the Minimi bipod is a height-adjustable item, with three positions of latch-secured adjustment for different heights of prone shooting and spade-type feet for a solid engagement with the ground. When not in use, the bipod swings up and clips into position under the forend of the gun. The bipod is ideally suited for assault use, the gunner being able to move into an improvised firing position, quickly fold down the bipod, and swing the gun into action.

The next step up from the bipod is the tripod. In actual theaters of conflict, it can be quite rare to see the Minimi set on a tripod; the gun is most commonly used from a bipod or a vehicular mount. However, the tripod is sometimes used to emplace the M249 in a static defensive position, from which the superior stability and control of the tripod will give the gun its maximum effective range capability. The traditional type of tripod system used on the Minimi is the US M122. It consists of a tripod head, which fits into a bracket on the underside of the gun, a single front leg, and a pair of rear legs. The rear legs are connected by a traversing bar, which supports the tripod's traverse and elevation (T&E) mechanisms.

Families of soldiers of 1st Battalion, 10th Marine Regiment (2nd Marine Division) get acquainted with the M249, here set on the M122 tripod; note the elevation and traversing wheels. (USMC)





and is designed to allow the tripod to collapse to fold into a closed position for carrying or storage, or to lock in the open position for use.

The T&E mechanism allows the gunner to fine-tune his firepower. Engraved on the traverse bar is a scale measuring direction in mils, and graduated in 5-mil increments. A traversing handle attached to the mechanism can be turned; depending on the direction of the turn the muzzle of the weapon will move either to the left or right. Each click of the traversing handwheel equates to a 1-mil change in direction of the muzzle, with a total of 100 mils representing complete traverse adjustment. Another handwheel on the T&E mechanism controls elevation, and works on a similar principle as that for traverse. The US Army's manual on the SAW explains the mechanism: "The elevating handwheel has a mil-click device built into it (1 click equals 1 mil). Engraved into the handwheel is a scale divided into 5-mil divisions and 1-mil subdivisions, for a total of 50 mils increments. There are 200 mils above and 200 mils below the zero mark, for a total of 400 mils in elevation change" (US Army 2003: 1-32).

In US service the M122 tripod has now largely been replaced by an updated version, the M192 Lightweight Ground Mount (LGM). This tripod is, in fulfillment of its name, lighter than the M122 at 11lb. It also features independently moving rear legs plus an improved lever-type system for adjusting traverse and elevation.

As well as being a dismounted infantry weapon, the Minimi has also found very wide usage in vehicles, of various types. The Minimi is ideally suited to mounting atop light armored vehicles, trucks, jeeps and military cars, ship side-rails, naval fast-attack craft, and even helicopters. There are a wide range of vehicular mounts available. The most simple are pintle or pedestal mounts, these being straightforward posts topped with a hinged

Atop his armored vehicle, Staff Sergeant Eric Barrios, a dog handler with the 36th Security Forces Squadron, US Air Force, is flanked by a shield-protected Minigun and an M249 Para, the latter mounted on a swing-arm mount. (US Air Force)



Here an M249 SAW has been fitted to a Special Weapons Observation Reconnaissance Detection System (SWORDS), atop a Foster-Miller TALON remotely operated tracked military robot. The SWORDS allows the gun to be fired remotely by an operator as far as 1,000m (1,094yd) away. (US Army)

fitting that locks onto the gun bracket via locking pins. A step up from the pintle mount is the swing-arm mount. As its name suggests, the swing mount fixes the gun on the end of a hinged arm, to give it a greater range of lateral movement around the vehicle, often with the option of locking adapters to fix the gun into a firing position when required. One popular example is the Platt Swing Mount, originally designed for the Australian Army's ASLAV 8x8 armored cavalry vehicle program. Produced in either a stainless steel or lightweight aluminum version, the Platt Swing Mount accepts either a MAG or a Minimi, with 130° weapon traverse left and right of front axis, and +80° elevation and -60° depression angles of fire. It has been adopted for service by numerous countries, including Australia, Canada, Germany, Iraq, Italy, New Zealand, Saudi Arabia, the United Kingdom, and the United States.

The ultimate vehicular mounts for the Minimi are the new generation of remote weapon stations (RWSs): electrically powered mounts that, via sophisticated fire-control systems, allow the user

to operate the weapon with precision without actually having to handle the gun itself. RWS technology has its most obvious application on armored vehicles, allowing the weapon operator to remain safely ensconced behind armor plate while at the same time being able to operate the Minimi; but as FN publicity is quick to point out, these mounts can also be used around buildings such as government facilities or military bases, or on border outposts or even prison security towers.

A fine example of the type from the FN stable is the deFNder® Light system, which can take both the Minimi and the MAG. The gun can be fitted into the powered mount in just 15 seconds, and once in the cradle the gun has +80° elevation and -60° depression angles of fire, plus full 360° traverse. The mount is also fast on target acquisition, moving 90° per second through both elevation and traverse, and is fitted with a standard day sight with narrow and wide fields of view, and/or optional low-light and night-vision sights. It also has a sophisticated "Weapon Management System," which provides an ammunition counter, an end-of-belt cut-off system, and an adjustable burst length.

All optical and weapon management information is delivered to the operator's RWS. In addition to all the standard fitments to the deFNder® Light system, the FN website lists the following as options for additional levels of firepower and fire control:

- Night sight (LLCCD, IR thermal sight)
- LASER Range Finder + ballistic computer
- Ballistic protection STANAG 4569 Level 1
- Higher capacity ammunition box



- Firing residues collector
- Stabilization for firing on the move
- Interface with sensors (e.g. SADLS, LWR)
- Remote operation via cable
- Networkable system linked through vehicle comms
- Target tracking system
- Built-in firing mode
- “Playstation”-type control handle

This M249 SAW is fitted to the roof of a US Army Humvee by means of a simple swivel mount, locking onto an adaptor just beneath the gas block. (US Army)

The deFNder® Light system is far from the only RWS on the block. Other good examples used on the Minimi/SAW include the gyro-stabilized Common Remotely Operated Weapon Station (M101 CROWS or M153 CROWS II), which includes a laser rangefinder and ballistic correction computer, and the M151 PROTECTOR Remote Weapon Station, which also features smoke-grenade dischargers.

The Minimi becomes a very different weapon depending on the mount, this flexibility meaning that in some ways the gun would approach the classification of general-purpose machine gun, were it not for the light caliber of the round it fires. Its capabilities are also transformed by the sights it uses. The Minimi comes fitted as standard with a set of two iron sights. At the front of the gun, sitting over the gas block, is a hooded front sight with a simple post. The rear sight sits on top of the rear feed tray cover, its rear aperture adjustable for both windage and elevation via two knobs on the left side of the sight. On the elevation knob, each click equals one half-mil adjustment, with the same principle applied to the windage control. Elevation settings are given for ranges of 300–1,000m (328–1,094yd). The top end of that range scale is a bit of a stretch for iron sights, as the gunner will scarcely have visual contact with a target at such

In this intriguing photograph from China, a Minimi-type weapon is mounted to a police security vehicle. Minimi clones in the arms of Chinese police have appeared in several photographs. (CC-BY-SA-3.0)



ranges, although he will be able to engage larger area targets. The optimal range for the iron sights is more in the region of 300–600m (377–654yd).

While iron sights serve the soldier well, today's Minimi gunner has a far broader range of sighting options available. In fact, with the near-standard application of mounting rails to Minimi guns, today's gunner can mount just about any relevant sight available on the market – depending on accessibility and cost, of course. Fitting one of the new generation of battle scopes enables the gunner to take full advantage of the SAW's range, provides greater visual "lock on" to the target, and also delivers quicker target acquisition across the range of the gun. It used to be the case that basic infantry scopes might be fitted to the Minimi, such as the standard SUSAT rifle scope used in the British Army, but optical sights have become increasingly specialized and versatile. A case in point is the Trijicon Advanced Combat Optical Gunsight (ACOG), which has achieved widespread adoption on Minimi-type weapons, especially in the US armed services and British Army. There are several varieties of the ACOG, but a good example is the TA11MGO-M249 Machine Gun Optic (MGO), designed by Trijicon specifically for the M249 SAW



US Air Force and Royal Australian Air Force (RAAF) personnel chat during guard duty at Baghdad International Airport, 2007. One of the RAAF men has an F89 (the Australian Minimi) fitted with a night-vision scope. (US Air Force)



system. The optic is illuminated through a combination of fiber-optic technology and self-illuminating tritium components, meaning that the sight does not need an external power supply to keep the target illuminated. In fact, the fiber-optic components mean that the gun reticle adjusts its brightness levels during daylight to suit the ambient light conditions. The illuminating quality of the sight allows the gunner to keep both eyes open while engaging the target, the reticle picture almost appearing as a head-up display in his vision. With its Bullet Drop Compensator feature, the MGO also helps to ensure accuracy out to the full 1,000m (1,094yd) range; the ranging reticle is graduated from 100m (109yd) to 1,000m (1,094yd). The MGO is also designed to accept Trijicon's Ruggedized Miniature Reflex (RMR), a small illuminated red-dot sight that provides the gunner with an exceptionally quick target acquisition at close range, such as in urban combat.

The ACOG is by no means the only excellent model of optical sight gracing the top cover of the Minimi in military service. Other common products include the ELCAN M145 3.4x Optical Sight, an LED-illuminated system designed specifically for the US Army for its M249 and M240 machine guns. ELCAN also makes the popular Specter® OS3.4x (designated the C79 in Canadian service) and Specter® M145 fixed-magnification sights – durable and easy-to-use scopes that feature shock-protected optics – both of which display ballistic correction information on the scope reticle.

Using the Minimi's integral iron sights, a US Army gunner conducts reflexive fire training in Ar-Ramadi, Iraq, in 2009.
(US Army)



The Minimi in its overwatch role – two US Army soldiers scan for enemy activity from a building in Mosul, Iraq, on November 9, 2004. (US Army)

Beyond optical aiming, the Minimi has also been fitted with a spectrum of more specialist aiming devices, particularly night-vision scopes. The US Army field manual FM 23-14 (*M249 Light Machine Gun in the Automatic Rifle Role*), issued in January 1994, came with an extensive section on the use of the Raytheon AN/PVS-4 image-intensifying sight, for shooting in low-light conditions. Since then, numerous other models – including advanced types from Raytheon – have entered the market and kept the SAW gunner functioning on even the darkest of nights. One of the latest models used on the SAW is Raytheon's AN/PAS-13(V)2, which uses thermal-imaging instead of passive image intensification, meaning that it can operate in the total absence of any light. The user even has the option to select how the heat-contrast picture will be represented, with either black or white representing the “hot” parts of the scene through the scope. British and Australian forces use similar thermal-imaging sights such as the Qioptiq VIPIR-2 TI, which has the power to detect a human at 1,200m (1,312yd) at night.

The fitting of mounting rails to the Minimi has opened up a wider world of accessories, beyond just a simple scope. The gunner obviously has to use a



certain degree of judgment here: devices might appear technologically tempting in a brochure on a depot shelf, but attaching too many devices to a gun can radically affect the balance and handling of the weapon. Nevertheless, there are some devices that Minimi gunners have found useful in combat, and which are commonly seen clamped around the front end of the weapon. A case in point is the laser aiming device. At its most basic, the aiming laser is little more than a pointer, projecting a visible beam of laser light in low-light or nighttime conditions. More sophisticated devices, such as the American Multifunction Aiming Light (MFAL), combine both visible laser and infrared lasers, the latter being visible for up to 2,000m (2,187yd) on the device's highest power setting through infrared goggles. Weapon-mounted lights are also seen on the Minimi – particularly useful for illuminating the scene during nighttime urban operations. Miniature laser rangefinders are also a useful addition, the equipment providing precise range calculations to the gunner, who can then adjust his sights or fire accordingly.

What is apparent in the modern age is that firearms are just one element of what is very much an integrated package of infantry technology. Through judicious and familiar use of the technologies available, a Minimi gunner can dramatically enhance the speed of target acquisition and the precision of fire, thus maximizing the capabilities of his weapon. Yet as always throughout the history of soldiering, technology is only of use if the soldier has mastered the fundamentals of gun handling.

This fine view of an M249 in action shows the gas diversion delivered by the blank-firing adaptor. The soldier is aiming using an ELCAN ELC145 3.4x Combat Optical Sight. (US Army)

FIRING POSITIONS

The Minimi, like any machine gun, requires a well-trained gunner to optimize the qualities of the weapon, both tactical and technological. The Minimi essentially occupies two tactical roles: that of an LMG and that of an infantry automatic rifle (IAR). There is some sophistication required on the part of the gunner to understand these roles properly and to work within the limitations and opportunities in the weapon. For example, although the Minimi is a rapid-fire weapon, it is not designed to throw down hundreds and hundreds of rounds in heavy sustained fire. Nor is it ideally suited to striking out against hardened targets (concrete bunkers, armoured vehicles, etc.) in the far distance. What the Minimi is good for is providing a fire team or defensive position with a ready and maneuverable source of suppressive firepower, one that a single gunner can wield with nearly the same physical dexterity as the rifles of the soldiers around him.

Because of the comparatively manageable dimensions and weight of the Minimi, the gunner has a wider variety of options for firing positions when compared to larger machine guns. The US Army manual *Warrior Skills Level 1* (2006) devotes an entire section to how to “Engage targets with an M249 machine gun.” One of the most critical aspects it highlights is the necessity for the correct physical firing position, instructing the gunner to “assume the position that will allow you to observe and engage targets, yet minimize your exposure to enemy fire” (US Army 2006: 3-331). The recommended position for handling the weapon is “Bipod-supported prone. The bipod-supported prone position and the bipod-supported

This photo shows three elements of British Army infantry firepower: an L85A2 IW (front); an L110A1 Para Minimi; and, in the background, the heavier 7.62mm L7A2, the British version of the FN MAG. (Cpl Dan Bardsley RLC/MoD)





fighting position are the best positions for delivering effective fire on targets. Assume these positions when possible" (US Army 2006: 3-332). The bipod-supported prone position is ideal not only because it places the gunner close to the ground, and therefore makes him the smallest possible target to the enemy, but also because it allows him to adopt the physical position most conducive to controlling the weapon: legs spread wide with the heels on the ground to brace the body; shoulder, torso, and right leg in alignment with the weapon, to handle the forces of recoil and consistently line up the shooting eye with the sight; one hand on the pistol grip and the other gripping the top of the stock to stabilize the gun. By putting himself into this position, the gunner will be better placed to put rounds consistently on target and to adjust his fire with great precision. The FM 23-14 manual explains how, in this position, the gunner should use his body to apply both traverse and elevation (searching).

A Dutch soldier provides security with a Minimi LMG during Exercise *Allied Spirit* at the Joint Multinational Readiness Center in Hohenfels, Germany, 2015, his gun fitted with a tactical light and laser aiming device. (US Army)

Traverse moves the muzzle of the weapon to the left or right to distribute fire laterally. Search moves it up or down to distribute fire in depth.

a. Traverse. To make minor changes in direction, the automatic rifleman shifts his shoulders to the right or left to select successive aiming points in the target area. Major changes require him to redistribute his weight to his elbows and toes and raise his body off the ground. Using his toes, he shifts his body to the right or left to be in the opposite direction of the target, and pivots on his elbows until he is once again aligned with the target. He rapidly assumes a steady position, obtains the proper sight picture, and engages the target.

Fundamentals of M249 Shooting – US Army Instructions

The four fundamentals for firing the M249 are **steady position, aim, breath control, and trigger control**.

a. **Steady Position.** In automatic fire, position is the most important aspect of marksmanship. If the automatic rifleman has a good zero, aims his weapon correctly, and properly applies a steady hold in firing a burst of three rounds, the first round of that burst will hit the target at the point of aim. However, this is not necessarily true of the second and third rounds. The first round hits the aiming point the same as when a round is fired singularly. The recoil from the first and subsequent rounds will progressively disturb the lay of the weapon with each round of the burst. The relationship between the point of impact of the first and subsequent rounds of the burst depends on the stability of the automatic rifleman's position. His body, directly behind the weapon, serves as the foundation, and his grip serves as a lock to hold the weapon against the foundation. The better the body alignment and the steadier the grip, the less dispersed the rounds of a burst of automatic fire will be.

b. **Aim.** To aim the M249 AR, the automatic rifleman must align the sights, focus his eye, obtain a correct sight picture, control his breathing, and maintain trigger control.

(1) *Sight alignment.* Align the rear sight aperture (peep sight) with the sight post of the hooded front sight. Then, align the front sight post in the center of the rear peep sight. An imaginary horizontal line drawn through the center of the peep sight should touch the top of the front sight post, while an imaginary vertical line through the center of the rear peep sight should bisect the front sight post.

(2) *Focus of the eye.* A good firing position places the eye directly on line with the center of the rear sight. Focus on the tip of the front sight post. The natural ability of the eye to center objects in a circle and to seek the point of greatest light (center of peep sight) aids in providing correct sight alignment.

(3) *Sight picture.* A correct sight picture has the target, front sight post, and rear sight aligned. The sight picture consists of sight alignment and placement of the aiming point on the target. Align the tip of the front sight post in the center of the rear peep sight and then align the sights with the target. Align the top of the front sight post on the center base of the target.

c. **Breath Control.** Two types of breath control are used. When firing single shots, as in zeroing, the automatic rifleman stops breathing after most of the air has been exhaled during the normal breathing cycle. He fires before he feels any discomfort. During automatic fire, ideally, the automatic rifleman exhales and stops his breath when pressing the trigger. He does not have time to take deep breaths between bursts. He must hold his breath before each burst or adapt his breathing by taking quick shallow breaths or taking deeper breaths between several bursts.

d. **Trigger Control.** Pressing the trigger straight to the rear and releasing it helps control the number of rounds in each burst and prevents disturbing the lay of the weapon. For a three-round burst, the automatic rifleman presses the trigger to the rear, says "Press, release;" and releases the trigger. (US Army 1994: 5-5)

b. **Search.** Searching is moving the muzzle of the weapon up or down to distribute fire in depth. To make changes in elevation, the automatic rifleman moves his elbows closer together to lower the muzzle or farther apart to raise the muzzle. Gross errors in range are corrected by adjusting the range setting with the elevation knob. (US Army 1994: 5-14)

Although the bipod-mounted position is the preferred option, the fact that the Minimi is light enough to carry in the assault or during a foot patrol means that the operator has to become familiar with a more varied array of firing positions, to ensure that he can deliver or return fire on the move. For short, aimed bursts, the Minimi can be fired from the shoulder, although the *Warrior Skills Level 1* manual notes that "Use the shoulder firing position to engage targets at ranges less than 100 meters [109yd] when no other position can be assumed or when the situation dictates its use (for example, in the final stages of the assault)" (US Army 2006: 3-332). The manual goes on to instruct in the techniques of firing the SAW



from underarm (gripping the stock between the bicep and the chest) and hip (bracing the stock against the thigh) positions, as techniques for delivering close-range bursts of suppressive fire as the gunner actually moves up to his objective. However, the illustrations accompanying the descriptions show the gunner, when adopting any of the standing positions, having to lean forward significantly, placing almost his entire body weight over his front leg to counteract the Minimi's recoil. The recoil is not severe – it imparts more of a fast rhythmic juddering to the shoulders – but that motion, combined with the inherent muscle tension of mounting the gun in a standing position, makes standing fire inherently inaccurate, and suitable for only the closest targets.

The Minimi gunner's accuracy is also aided by the ammunition itself. Typically, most Minimi users compose the ammunition belt of one tracer round for every four ball rounds, to give the gunner a clear sense of the trajectory of his fire. He has to make the most of his experience and judgment, however, as tracer rounds lose mass as the incendiary compound burns out during flight, meaning that they slow down and lose trajectory quicker than the accompanying ball rounds. Complete belts of tracer are rarely, if ever, used because they would deposit excessive amounts of corrosive tracer compound in the barrel.

Here a US Marine prepares to fire a rifle grenade from the muzzle of his M249 SAW. Note also that he is using a standard STANAG magazine as the feed system. (USMC)

HANDLING AND MAINTENANCE

Maintenance is usually a fairly uncontroversial topic in the world of firearms, but regarding the Minimi there are elements of contention, based on some adverse feedback from soldiers in the field. Such feedback should be treated with caution, however. I struggle to think of a single weapon, with the possible exception of the AK-47, that has not at some point in its service career attracted adverse comment for either mechanical failings or problems with serviceability. The terrible press coverage given to the US M16 and British SA80 rifles – both now time-served and respected weapons – at points in their service careers serve to illustrate this point. So any criticism of the Minimi must be seen in light of the extremely punishing conditions within which military firearms exist, plus the fact that any service firearm goes through modification and adaptation throughout its lifespan, dealing with problems as and when they are encountered.

Before looking at some of the issues raised, it is worth pointing out that the Minimi is unlikely to have achieved the success it has, over such a lengthy career, if it had not been a fundamentally reliable and functional weapon. The US Army trials that the Minimi underwent to become accepted as the M249 SAW were arduous in the extreme, putting tens of thousands of rounds through individual guns in all manner of weather, temperatures, and environmental conditions. Indeed, it was the Minimi's reliability in these trials that in large part helped it overcome the opposition. If there were any critical faults in the fundamental operating system, they would likely have emerged during these trials. We must also allow for the fact that a very high percentage of operating faults in firearms are on account of human error, either during servicing or handling, although it should always be a manufacturer's objective to design a weapon and corresponding maintenance program that allow for user fallibility.

In terms of basic operational functions, the Minimi is simple to operate. The barrel change, for example, can be performed in a matter of seconds by working through the following steps:

(1) The gun is cleared of any ammunition, and the bolt is cocked and locked to the rear. (The barrel change cannot be performed if the bolt is locked into the breech.)

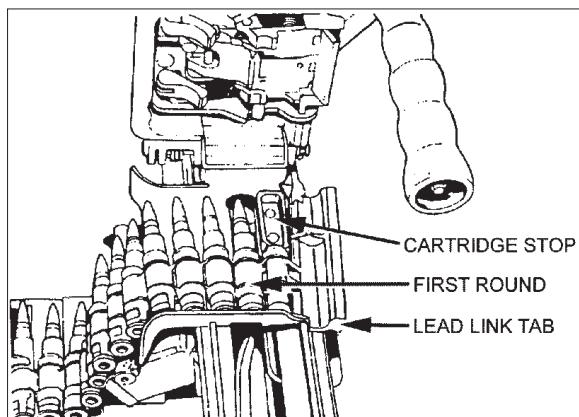
(2) The weapon is set to SAFE.

(3) The gunner pushes down the locking lever with the left-hand and grabs the barrel handle with the right hand, pushing it forward and up to remove the barrel from the receiver. (The gunner needs to avoid touching the barrel itself, as it could be dangerously hot.)

(4) The new barrel is installed by simply reversing Step 3, and ensuring that the barrel is locked into place before the gun is reloaded and fired.

This process is ideal for a combat machine gun, being simple enough to

A US Army manual diagram illustrates the correct positioning of the 5.56mm ammunition belt in the feed tray of the M249 SAW.
(US Army)





Having raised the top cover, this US Marine is about to place the first round of a new belt into the feed mechanism of his M249 SAW. (USMC)

ensure a minimum of vulnerable downtime while changing barrels.

Every gunner assigned to a Minimi has to be conversant with the preventive maintenance required to keep the gun operating optimally. This means ensuring that the gun is field stripped, cleaned, and lubricated properly after every major use. Lubrication is an especially critical issue, both in the type of oil used and the volume of oil applied. Many of the reliability problems with the Minimi originated during Coalition deployments to Iraq from 2003. Iraq was, and remains, an environment that is particularly hard on all weapons, not just the Minimi. The fine airborne dust and sand particles easily enter a gun mechanism (typically via the ammunition belt and the feed mechanism), and the accumulations can build up to cause weapon malfunctions, both stoppages and breakages. If too much oil is applied to the moving parts, or if the oil type is too viscous, it can mix with the grit and sand to form a grinding paste, wearing away at parts and introducing an extra level of inertia in the operating system. Hence oil should be applied to moving parts only as a thin film, and almost wiped off after application. In terms of the oil type, the US armed services have adopted as standard what is known as “CLP” oil – Cleaner, Lubricant, Preservative. A military specification issued on May 15, 2008 (MIL-PRF-63460E) describes the properties and qualities of the oil type, and the document especially focuses on the applications of the oil to the M249:

3.5.2 Weapon performance. CLP shall provide cleaning, lubricating and preservative characteristics to support operating requirements of the MACHINE GUN: 5.56MM, M249, when exposed to the following conditions.

3.5.2.1 Cold temperature. CLP applied to an M249 that is then exposed to severe cold for 18 hours shall prevent any Class II or III stoppages, shall allow not more than two Class I stoppages in 200 rounds, and

US Army preventive maintenance advice relating to the M249 SAW

Preventive Maintenance. Weapons that are seldom fired or stored for prolonged periods should have a light film of CLP applied to the interior of the gas plug, the gas regulator, and the piston immediately after cleaning or inspecting. Preventive maintenance is performed every 90 days, unless inspection reveals more frequent servicing is necessary. The use of the lubricant does not eliminate the need for cleaning and inspecting to ensure that corrosion has not formed. The gas regulator, gas plug, and piston must be clean and free of oil and lubricants before using the weapon. If it is not clean and oil free, stoppages will occur. CLP is the only lubricant to use on the M249 machine gun. The following procedures apply to cleaning and lubricating the M249 machine gun during unusual conditions:

- (1) Extremely hot use CLP, grade 2.
- (2) Damp or salty air use CLP, grade 2. Clean and apply frequently.
- (3) Sandy or dusty areas use CLP, grade 2. Clean and apply frequently. Remove excess with a rag after each application.
- (4) Below -18 degrees Celsius (0 degrees Fahrenheit) use CLP, grade 2, generously. Lubricate heavily enough so that the lubricant can be spread with finger. Although CLP provides required lubrication at temperatures between 0 degrees Fahrenheit and -35 degrees Fahrenheit, it will not flow from a 1/2-ounce bottle at temperatures below 0 degrees Fahrenheit. (US Army 2003: 1-21)

shall sustain a rate of fire of at least 650 rounds per minute (rpm).

3.5.2.2 Dust environments. CLP applied to an M249 that is then exposed to very fine blowing dust for 50 minutes shall prevent any Class II or III stoppages, shall allow not more than five Class I stoppages in 500 rounds, and shall sustain a rate of fire of at least 650 rpm.

3.5.2.3 Salt-spray environments. CLP applied to an M249 that is then exposed to a salt-spray environment for 96 hours shall prevent any Class II or III stoppages, shall allow not more than two Class I stoppages in 200 rounds, and shall sustain a rate of fire of at least 650 rpm. (US DoD 2008)

By way of explanation, a Class I stoppage is one a soldier can clear within 10 seconds of the malfunction occurring; a Class II stoppage can be cleared by the operator, but requires more than 10 seconds; and a Class III stoppage is one that requires an armorer to clear. The correct application of CLP oil, and any other appropriate lubricant for that matter, goes a long way to preventing malfunctions – but implicit in this reassurance is the acceptance that cold, dusty or salty environments can and do result in weapon stoppages if a lot of rounds are put through the exposed gun.

Note that in theater realities, CPL is far from the only lubricant used by soldiers. In a survey conducted among US troops in 2006, it was discovered that about 23 percent of troops used a non-Army lubricant.

Setting aside the issues of preventive maintenance, some concerns have been raised within the US military forces about certain aspects of the M249 SAW's functionality and unreliability. The scientific accuracy of more conversational reports is hard to quantify. One official source deserving respect, however, is that issued by the US Army's Small Arms



The bolt assembly is removed from a Minimi. Note the lug at the top of the bolt, which engages with the feed track operating the feed driving mechanism. (USMC)

Assessment Team (SAAT) in July 2003, working in tandem with the Project Manager Soldier Weapons (PMSW) to evaluate the performance of weaponry during the first months of Operation *Iraqi Freedom*. In the report, the authors observe that

a number of universal issues were voiced related to the M249 SAW maintainability, the M203 durability, lubrication types, and magazines. SAW gunners were unanimously dissatisfied with the complexity of the M249 SAW. Its numerous small parts encumbered field stripping and were easily lost. Some SAW gunners resorted to extremely unorthodox methods to retain weapon availability. The M249 SAW was the most problematic weapon in the theater. (PMSW 2003: 8)

That final sentence is clearly a very serious statement indeed, and one that deserves explaining in a little more detail. The report's authors go on to include an explanatory statement:

The biggest issue among M249 SAW gunners is the 200-round plastic ammunition box. Some box and weapon interfaces were observed as weak and unreliable. SAW gunners consistently remarked that the box habitually falls-off no matter the movement technique: walking or rushing. The spring tension is insufficient to retain the box in the slot. Soldiers are using bolts, screws or wire to act as a retaining pin in order to keep the box from slipping from the slot. The box was extremely brittle and prone to break, especially at the box and weapon interface. Discussions with weapons engineers upon return to CONUS revealed that the weak interfaces were previously addressed in a change of the plastic ammunition box design. Some of the problems encountered may have been due to issue of the old design ammunition boxes. Also, the ammunition tends to rattle against the box and soldiers were using MRE [Meals Ready to Eat] cardboard or moleskin to buffer the noise. However the M249 SAW 100-round soft Combat Ammunition Pack (CAP) was universally praised and was preferred over the 200-round

An M249 is given some basic winter camouflage before US Marine Corps cold-weather training at the Camp Ethan Allen Training Site in Jericho, Vermont. It is easier to apply such camouflage to the Minimi because the gun does not have a reciprocating cocking handle. (USMC)



plastic box. Gunners conveyed that they would rather repack their ammunition basic load in several 100-round soft pouches than use the 200-round plastic box. (PMSW 2003: 8)

Taking the issue of maintainability/reliability first, the Minimi is indeed not the simplest of weapons to disassemble and maintain, at least when compared to some rifles. In total there are eight major parts groups in the Minimi: operating rod group, barrel and buffer assembly group, handguard group, buttstock and buffer assembly group, trigger mechanism group, gas cylinder group, bipod group, and receiver group. Some of these groups, particularly the operating rod group, contain many parts, with the possibility of losing bits and pieces in a dirty battlefield or base camp situation. The SAW does not take a long time to strip. One video on YouTube shows a US soldier disassembling a SAW sufficient enough for a field clean and assembling it again, in one minute 45 seconds – and the commentary accompanying the video emphasizes that the field strip was performed “slow” and not for speed. Yet the persistence of comments about field serviceability, including issues such as the gun’s susceptibility to corrosion,

Brazilian Special Forces, Brazil, 2005 (opposite)

The Minimi has had a truly global distribution, being one of the most commercially successful machine guns of the post-1945 era. Several South American countries have taken the Minimi as either a standard-issue or a specialist weapon. Here we see two members of the Brazilian *Comando de Operações Especiais* (Special Operations Command), performing a full strip and clean of a Minimi during an operation against drug cartels in the country's jungle-covered interior. The soldier on the left is using a pull-through cleaner to wipe out the bore, while the soldier on the right is using a solvent-soaked toothbrush to clean propellant deposits off the bolt head. On the mat in front of them we see all the major sections of the gun, including the feed assembly (with the top cover in the raised position), the bipod unit, and, just in front of the figure on the right, the operating rod group. In hot and humid places, regular cleaning and proper oiling of the Minimi is a must, as rust can quickly take hold in such environments.





The PEO M249 Soft Ammo Pack. The soft packs have generally proved more popular than the hard-cased ammo boxes, as they are lighter than the rigid containers and also quieter during covert movement. (US Army)

appear often enough to be taken seriously. It seems that maintaining the Minimi requires diligence, good management of the workspace, and proper training – but such perfection is not always easy to apply in a soldier exhausted after a long operation.

Looking now at the feed issue, it is clear that the hard-plastic ammunition boxes, while offering greater capacity of cartridges, were regarded as inferior to the soft packs. Some critics of the SAW have taken their arguments further, suggesting that a belt-fed weapon in general is not an ideal tool in the IAR role. In April 2001, US soldier Ray Grundy published an article entitled “The M249 Light Machine Gun in the Automatic Rifle Role.” One of his criticisms of the M249 was that the ammunition feed configuration of the SAW made clearing a stoppage problematic:

My evaluation of the M249 SAW is based on firsthand field observation. How many times have I seen automatic riflemen in the attack confronted with a malfunction on the SAW causing them to take immediate action to clear the stoppage? The nightmare begins with the raising of the feed tray cover to identify and fix the problem. Oftentimes what happens is the ammunition belt will slide off the feed tray and fall back inside the ammunition drum. The Marine is now in a desperate situation. Not only does he have a weapon malfunction to clear, his problem is compounded because he is now faced with the challenge of what to do with the ammo inside the drum. Does he remove the ammo box from the weapon, hold it upside down, and attempt to shake the ammo belt out, or does he reach around for a new drum? All this time he remains out of action. His weapon is down; he is not engaging the enemy; he is unable to defend himself. His fire team is advancing and the fire coverage he is supposed to provide is lost. The Marine Corps should arm the SAW gunner, as we do the machine-gunner, with an M9 9mm pistol so that if presented with a similar situation he can at least defend himself. (Grundy 2001*)

Clearly, Grundy was addressing a serious issue, although the belt-retaining features on the new Mk 3 system squarely address the problem of the slippery belt. A useful way to gauge the extent of this problem is to look at a significant report issued in December 2006 by the Center for Naval Analyses (CNA), a defense consultancy organization. The report, entitled *Soldier Perspectives on Small Arms in Combat*, is a detailed qualitative and quantitative analysis of the performance of four main US Army weapon types: the Beretta M9 pistol, the M4 and M16 (A2 and A4) rifles, and the M249 SAW. The analysis was based on 2,600 soldier surveys, all conducted with veterans who had returned from Iraq and Afghanistan and who had actually used the weapons stated in combat; 341 of the men surveyed had used the M249 SAW. The time of writing is also interesting, as it illustrates the state of weapons five years after Grundy was writing, and so reflects several years of official and field expedient improvements (although still not up to the Mk 3 standards).

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Some of the results reflected criticisms already made; for example, 30 percent of the soldiers interviewed were not satisfied with the maintainability of the SAW, citing the difficulty of removing and gaining access to some of the small components in the weapon. Conversely, this meant that 70 percent of soldiers *were* satisfied with M249 SAW maintainability – but the satisfaction figures for the other weapons in this category ranged between 81 percent (M9) and 87 percent (M4). More troubling was the fact that 35 percent of the M249-armed soldiers were not satisfied with the weapon's corrosion resistance.

On the issue of ammunition handling, 72 percent of the SAW gunners were generally satisfied with the performance of the weapon, although there were a range of opinions on the best type of ammunition container. When asked what their preference was in terms of container, 40 percent of the SAW gunners chose the 100-round soft pouch, 21 percent opted for the 200-round soft pouch, 21 percent chose the 200-round hard box, and 18 percent did not mind which type of feed they used. The results seemed to indicate that the soft pouches are the container of choice – but why did more prefer the 100-round pouch than the 200-round pouch, with its larger ammunition capacity? The answer probably lies in another statistic gleaned from this invaluable survey, in which a hefty 40 percent of the SAW gunners stated that they were not satisfied with the SAW's handling. When investigators analyzed this figure further, they found that of those who were not satisfied, 46 percent gave the gun's weight as their reason; the other major reasons were size (29 percent), handguard ergonomics (12 percent), and heat build-up (8 percent). Given that some individuals were obviously struggling with the weight of the gun itself, the 100-round soft pack would make for the lightest addition in terms of ammunition feed.

LEFT Japan is another Minimi user; here a soldier of the Japan Ground Self-Defense Force arranges a 100-round belt for loading. (USMC)

RIGHT A US Marine levels his M249 during a landing zone insertion and extraction exercise conducted at Camp Eggers in Asadabad, Afghanistan, 2004. (USMC)



New Zealand is one of more than 75 countries to adopt the Minimi, as exemplified by this soldier of the New Zealand Defence Force at work in Dili, Timor Leste (East Timor). In NZ service, the Minimi is known as the C9 Minimi. (NZDF CC-BY-2.0)

When it comes to the issue of stoppages, it is fair to say that a weapon malfunction in combat is one of the most serious situations a soldier can face; it is a moment that leaves the gunner unprotected, hopefully for just a few seconds, but on some occasions the gun might actually be inoperable and require repairs by an armorer. Unfortunately, of the four weapon types surveyed for the *Soldier Perspectives* report, the M249 came out worst – a full 30 percent of the 341 M249 gunners reported experiencing a stoppage with the weapon while engaging the enemy. By way of comparison, the other figures were 26 percent for the M9 and 19 percent for

both the M16 and the M4. The soldiers were also asked to report on how significant the stoppage was in terms of their ability to continue engaging the enemy. No fewer than 59 percent of the M249 gunners who had experienced a stoppage said that the event had a “large impact,” meaning that soldier was unable to use a weapon for either a significant portion of the firefight or for the entire firefight, even “after performing immediate or remedial action to clear the stoppage” (Russell 2006: 2). The remaining 41 percent classified their stoppage as having a “small impact,” meaning they were able to continue in the firefight after performing immediate remedial action.

These are clearly serious figures, and other reasons for the malfunctions are not stated. The immediate-action clearance drill for an M249 is as follows, and is easily remembered by the memory aid POPP: Pull, Observe, Push, and Press:

- a. Pull and lock the cocking handle to the rear while observing the ejection port to see if a cartridge case, belt link, or round is ejected. Ensure that the bolt remains to the rear to prevent double feeding if a round or cartridge case is not ejected.
- b. If a cartridge case, belt link, or round is ejected, push the cocking handle to its forward position, take aim on the target, and press the trigger. If the weapon does not fire, take remedial action. If a cartridge case, belt link, or round is not ejected, take remedial action. (US Army 2003: 1-38)

The remedial action is more involved, requiring the operator to open the feed cover, remove the ammunition belt, make a visual inspection of internal parts, and remove obstructions (such as a jammed cartridge) or identify the component failure. Interestingly, however, the CNA report



seems to suggest that one of the major causes of M249 malfunction might not be the gun after all, but rather the ammunition belt. At the end of the report, the authors present soldiers' recommendations for improvements for the M249; and joint top of the list, at 17 percent, were recommendations that the ammunition belt have better and more durable links and an improved drum feed system. Joint top of the list was the recommendation that the gun be made lighter. Other points focused on aspects such as making the ammunition packaging more secure and durable, reducing the noise levels of the gun, making the buttstock adjustable/collapsible (a problem clearly remedied in many variants of the Minimi), and increasing the caliber of the gun to deliver better lethality.

The upshot of the report was that 64 percent of the soldiers who had used the M249 SAW in combat said they were confident in the weapon system, which means 36 percent said they were *not* confident in the weapon system. Only the M9 scored worse in this analysis; the weapon that scored best was the M4, with 83 percent confidence. So what is to be made of these figures, given the Minimi's rigorous and successful testing and global commercial success? First, it must be recognized that the environments of Iraq and Afghanistan have been extremely hard on many weapon systems, from tanks to missiles, so the level of malfunctions generally increases in those theaters when compared to less arduous combat zones. Second, the ammunition problem seems to be greater than any issues with the M249s themselves. A statement made on a soldiers' forum about the M249 SAW includes a comment from one soldier that he used the Minimi regularly in Iraq without a single stoppage, but that he

Maintaining observation through night-vision goggles, a Chilean special-forces soldier fires an M249 during a training exchange exercise involving US and Chilean special forces. (US Army)



This Swedish soldier has a Ksp 90B, the Swedish version of the Minimi Para, manufactured by Bofors Carl Gustaf. The standard Swedish model is known as the Ksp 90. (US Air Force)

had a problem with the “crappy plastic ammo box” that kept breaking or falling off. He noted that as soon as he switched to the cloth (soft) ammo pack, the problem stopped. Third, machine guns by their fast-firing nature are subject to harder mechanical abuse than rifles, and the greater demands of cleaning can mean that the maintenance regime can suffer during demanding operational periods.

It appears that in many ways what the M249 SAW’s service in Iraq and Afghanistan has exposed are significant flaws in the weapon’s ancillary equipment rather than the gun itself. This is perhaps borne out by further comments by a Lieutenant Colonel Smith in a 2003 report, “Operation Iraqi Freedom: PEO Soldier Lessons Learned.” In it he notes of the SAW:

Overall positive comments on this weapon. It provided the requisite firepower at the squad level as intended. The short barrel and forward pistol grip allowed for very effective use of the

SAW in urban terrain. Soldiers requested a better stowage position for the bipod legs. The legs interfered with the attachment of the forward pistol grip. If a pistol grip was attached and the legs were down, the legs made movement in the restrictive urban terrain difficult. Additionally, the soft ammo pouches are great improvements over the plastic ammo canister. (Smith 2003: 3)

The observation about “positive comments” is refreshing. Also, note that Smith states that the SAW fulfilled its role to provide suppressive firepower at the squad level. This is indeed where the Minimi seems to excel.

COMBAT PERFORMANCE

“The [Iraqi] APC stopped. I couldn’t believe my eyes,” recalled SAS veteran Andy McNab.

It was using the machine gun as a fire base instead of coming forward with the infantry and overwhelming us, which was wonderful.

Everybody was getting the rounds down. The Minimis were fired in bursts of 3–5 rounds. Ammunition had to be managed. Two 66s [66mm light anti-tank missile weapons] were fired at the truck and found their target. There was a massive shudder of high-explosive. It must have been very demoralizing for them.

Decisions. After this initial contact, what are you going to do? Are you going to stay there all the time, are you going to move back, are you going to move forward? Everybody knew what had to be done.

We psyched ourselves up. It's unnatural to go forward into something like that. It's not at all what your vulnerable flesh and bone wants to do. It just wants to close its eyes and open them again much later and find that everything is fine.

"Everything OK?"

Whether people actually heard further down the line didn't matter, they knew something was going to happen, and they knew the chances were that we were going to go forward and attack this force that vastly outnumbered us.

Without thinking, I changed my magazine. I had no idea how many rounds I had left in it. It was still fairly heavy, I might have only fired two or three rounds out of it. I threw it down the front of my smock for later on.

Stan gave the thumbs up and steps up the fire rate on the Minimi to initiate the move. I was on my hands and knees, looking up. I took a deep breath and then up I got and ran forward.

"F*** it! F*** it!"

People put down a fearsome amount of covering fire. You don't fire on the move. It slows you up. All you have to do is get forward, get down and get firing so that the others can move up. As soon as you get down on the ground your lungs are heaving and your torso is moving up and down, you're looking for the enemy but you've got sweat in your eyes. You wipe it away, your rifle is moving up and down in your shoulder. You want to get down in a nice firing position like you do on the range, but it isn't happening that way. You're trying to calm yourself down to see what you're doing, but you want to do everything at once. You want to stop this heavy breathing so you can hold the weapon properly and bring it to bear. You want to get rid of the sweat so you can see your targets, but you don't want to move your arm to rub your eyes because you've got it in the fire position and you want to be firing to cover the move of the others as they come forward.

I jumped up and ran forward another fifteen metres – a far longer bound than the textbooks say you should. The longer you are up the longer you are a target. However, it is quite hard to hit a fast-moving man and we were pumped up on adrenaline.

You're immersed in your own little world. Me and Chris running forward, Stan and Mark backing us up with the Minimi. Fire and manoeuvre. The others were doing the same, legging it forward.
(McNab 1993: 111–13)

This first-hand account of SAS combat during the First Gulf War (1991), given in Andy McNab's famous work *Bravo Two Zero*, exemplifies why the Minimi has been so appreciated by worldwide forces in combat. It must be remembered that the soldiers portrayed by McNab were Special Forces, deep behind enemy lines, hence the Minimi was ideally suited to the requirement for portable but intensive firepower. In this engagement, the SAS troopers used the Minimi to tactical perfection, putting down streams of 5.56mm fire to enable the other soldiers to maneuver themselves

up toward the enemy. Fire from just one Minimi enabled the whole squad to advance under suppressive cover.

The First Gulf War was the initial major outing for the Minimi, in the hands of the US forces, British forces, and some of the other coalition partners. The story of British acquisition of the Minimi is of particular interest. It was used solely by Special Forces personnel during the conflict, because the SA80 Light Support Weapon (LSW) variant – also known as the L86A1, or later L86A2 in its updated variant – was the British Army fire team support weapon. Yet the LSW was essentially little more than an SA80 IW rifle with a slightly heavier and longer barrel and bipod support, and left a lot to be desired. The barrel was fixed, meaning that the gunner had to control his fire significantly to avoid weapon overheating. Furthermore, the ammunition feed was the standard rifle 30-round magazine, so particularly long bursts were all but out of the question. As for the LSW's reliability, it was terrible.

Many personnel in the British Army began pushing for adoption of the Minimi as a replacement for the LSW in the late 1990s. Yet it was only the tactical demands of deployment to Afghanistan in 2001 that forced the issue, which led in turn to the Ministry of Defence (MoD) being compelled to issue an Urgent Operational Requirement (UOR) for 600 Minimis, to boost squad firepower. Once the Minimi had been acquired, issued, and proved its worth, the momentum was unstoppable, and in 2004 it became the new squad support weapon of the British Army.

Britain is just one of dozens of Minimi users; and because of its prolific and international distribution, the weapon has been battle tested in almost every conceivable type of environment, and by very varied types of units. A quick search through the defense media brings up regular reports of Minimi sales to state governments. In 2013, for example, the Brazilian Army decided to adopt the Minimi as a replacement for the 7.62×51mm IMBEL M964 FAP (Fuzil Automático Pesado), as the standard squad machine gun. The Mexican Air Force has used Minimis onboard its combat helicopters. In March 2016, there were press reports that the government of Swaziland had made a large purchase of arms for its security forces, the acquisition including Minimis for both dismounted and vehicular use. The US market naturally remains by far and away the largest for Minimis and related parts. By way of example, in March 2008, FN Manufacturing Inc. in Columbia, South Carolina received a \$7.7 million contract for 17,433 M249 short barrels, which gives a sense of just how quickly M249 barrels were being burnt out or run beyond their operating life in the conflicts in Afghanistan and Iraq.

Apart from their use in major wars, Minimis have also been used by Brazilian special forces during counter-cartel raids in Latin America, in bloody civil wars in various African states, and in the hands of Middle Eastern terrorists or revolutionaries. For example, in May 2008, according to a BBC report (<http://www.bbc.co.uk/news/magazine-34810155>), FN Herstal agreed a major contract to supply arms to the Libyan leader Colonel Muammar Gaddafi, the total order including 367 5.56mm F2000 assault rifles, 367 5.7mm P90 personal defense weapons, 367 5.7mm Five-seveN® pistols, 50 9mm Browning Hi-Power “Renaissance”

handguns, 30 Minimis, 2,000 17.3mm FN 303 less-lethal launchers (riot guns), and more than a million rounds of ammunition. Needless to say, the collapse of Gaddafi's dictatorship and his subsequent death in October 2011 meant that many of the weapons, including the Minimis, ended up in other hands for other purposes. Indeed it is not unusual, although uncommon compared with many other weapon systems, to see Minimis in the hands of non-state organizations. In 2014, for example, pictures were released by the Tunisian Uqba bin Nafi Battalion, a jihadist group operating in Tunisia, showing one of its members holding a Minimi, captured in battle from the Tunisian armed forces. One especially concerning incident appeared in the British media in September 2010, after it was discovered that 59 Minimis had gone missing from British Army stocks. The mystery of where they had gone appears to have been solved when American forces recovered two of the guns following a battle with the Taliban in Afghanistan.

The Philippines also has an interesting relationship with the Minimi. In 2007, during the Armed Forces of the Philippines (AFP) Modernization Program, the FN Minimi was selected to be the new SAW. This decision



As this British soldier in the Falkland Islands shows, the L110A2 Para Minimi is capable of being fired from the shoulder in the kneeling position, although only short bursts are recommended. (Photo: Cpl Si Longworth, RLC (Phot)/MOD)

British Royal Marine, 42 Commando, Afghanistan 2011 (overleaf)

A British Royal Marine, armed with an L110A2 Minimi, lays down suppressive fire on an enemy-held building as two of his comrades make a flanking advance. He is directing the fire using an optical sight, the Lightweight Day Sight (LDS), and the sight picture is shown in the inset view. The LDS is a military version of the ELCAN Specter® OS4x, and it was adopted by the British armed forces, along with the Trijicon ACOG 4×32 sight, as a partial replacement for the SUSAT sights used on the SA80 rifle and, on occasions, the Minimi. This Marine also has a red dot reflex sight fitted atop the LDS, for use in rapid close-quarter fighting. Note also the firing position adopted here. The Minimi is admittedly a heavy weapon to fire from the shoulder, but it is viable to do so, although utilizing its integral bipod (seen here in the folded-down position) will improve its accuracy significantly over longer ranges. Although the Minimi is working well within its effective range in this scene, should the British troops attract fire from the higher ground it would face more of a challenge in terms of reach. Indeed, it is the experience of combat in Afghanistan, with its long-range engagements, that has generated an intense argument on both sides of the Atlantic about the efficacy of this weapon for long-range support.





actually prompted controversy, as many in the Philippines felt that the choice should have been made in favor of a Korean weapon, the Daewoo Precision Industries 5.56mm K3 LMG. A quick glance at the K3, which entered production from 1988, immediately shows that it is a fairly direct derivative of the Minimi. By choosing the FN weapon rather than a regional product (including Singapore's Ultimax 100, one of the Minimi's direct competitors), the Philippines government was accused of leaning toward Western suppliers. In the end the decision to go with the Minimi was reversed, and an order was placed instead for several thousand K3s (figures vary between 2,000 and 6,540 guns), the weapons entering service in 2008. The Philippine Minimis have been used in action to combat insurgencies across the island chain. A news report from June 2015 described a vicious firefight between soldiers and communist guerrillas in San Fernando, Bukidnon, in which three people were killed and the rebels managed to seize a K3, five M14 rifles, three M16 rifles, and an M203 grenade launcher. Other users of the K3 include Colombia, Fiji, Guatemala, Indonesia, and of course the Republic of Korea.

Despite the sheer number and variety of users, it is undeniable that the largest combat user of the Minimi has been the United States with its M249 SAW, and that the most extensive "combat laboratories" for the weapon have been Afghanistan and Iraq. Having already looked at some of the technical issues affecting the SAW that have arisen in these combat theaters, it is worth expanding the analysis to examine, through first-hand accounts, how the SAW has actually performed in action at a tactical level.

Looking at many of the after-action reports released from Afghanistan and Iraq, it soon becomes evident just how central the SAW has been to ground combat engagements, which is one of the reasons why the stoppages reported above have been such a signal issue. In the following report, a record of an attack on US troops near Basra in 2005, the SAW gunners respond quickly to hostile activity:

At 2128, a patrol heading to Basrah [sic] to pick up 3 US soldiers was attacked on MSR Tampa, IVO CP36B, at 38R QU 4201 6609. When the patrol was making a turn from MSR TAMPA onto a dirt access road, the patrol saw approximately 3 lns [suspect people] coming from under the over pass 150m [164yd] to the northeast. The gunner of the lead vehicle turned his turret in order to track the individuals, at which time, he saw an explosion in between the lead and second vehicle. The second vehicle saw a possible smoke trail prior to explosion. The lead gunner observed the 3 lns moving up the slope and saw the individuals raise weapons and point them in the direction of his vehicle. The lead gunner engaged the enemy with his M249 SAW firing approximately 200 rounds. He fired sustained bursts until the 2nd vehicle had cleared the ambush site. The trail gunner fired approximately 20 rounds of M249. Unknown EBY BDA [enemy battle damage assessment]. The patrol moved 1 kilometer [0.62 miles] from the ambush site and checked all personal and vehicles. No injuries or damage reported. Patrol continued mission. The incident was reported on sheriff net. The two vehicles were M1026 with Level II armor. (US Army 2005)



We get a sense from this report that one of the advantages of the SAW is how quickly it can be brought to bear in response to an immediate threat. In many ways this is the *raison d'être* of the Minimi – it can provide even the smallest of units, the four-man fire team, with a ready source of heavy firepower. Here the SAWs are vehicle mounted, however, and what is notable is how much fire the lead gunner quickly lays down, running through what was likely a 200-round ammunition box. In this particular action, the gunner delivers “sustained bursts” with such intensity that he “cleared the ambush site.” Note that the report does not mention whether the attackers were killed or injured (although they likely were), but we get a real sense of the volume of fire from the SAW performing the suppression role to perfection.

A similar demonstration of SAW use appears in the following account, which relates to a response by Raven 42, a small Military Police (MP) unit of the 617th MP Company, Kentucky National Guard, to a major insurgent attack on a civilian truck convoy in an area called Salman Pak, on the southeastern outskirts of Baghdad. Here the writer, a brigade S-2 (Intelligence Officer), recounts the moment the soldiers went into action, deploying from three Humvee vehicles:

The MPs crossed the kill zone and then turned up an access road at a right angle to the ASR [Alternate Supply Route] and next to the field full of enemy fighters. The three vehicles, carrying nine MPs and one medic, stopped in a line on the dirt access road and flanked the enemy positions with plunging fire from the .50 cal and the SAW machinegun (Squad Automatic Weapon). In front of them, was a line of seven sedans, with all their doors and trunk lids open, the getaway cars and the lone two-story house off on their left.

In this highly dramatic image, soldiers of the US Army's 101st Airborne Division return fire against a Taliban attack in the valley of Barawala Kalet, Kunar Province, Afghanistan, on March 29, 2011. (US Army)





SHUMATE
2016

US Marine Corps, Iraq 2003 (previous pages)

Amid an urban firefight in central Baghdad, a US Marine fire team cooperates in a barrel change on an M249 Squad Automatic Weapon (SAW), the scattered cartridge cases and spent belt links indicative of the intensity of the fighting. The weapon's gunner has just removed the barrel assembly (which also includes the gas regulator) from the lower receiver, using the carrying handle to lift the unit clear of the gun body, ready to replace it with a new barrel unit. To his right, an assistant prepares a 200-round plastic ammunition box for loading. In the hands of a well-trained gunner, a barrel change can be performed in a matter of a few seconds. It is this facility that separates the Minimi from fixed-barrel light machine guns, which are prone to overheating issues if rapid or sustained fire is attempted. Because the SAW can switch out its barrels, it can fire at a rapid practical rate of 200rd/min, allowing for a barrel change every two minutes.

Immediately the middle vehicle was hit by an RPG knocking the gunner unconscious from his turret and down into the vehicle. The Vehicle Commander (the TC), the squad's leader, thought the gunner was dead, but tried to treat him from inside the vehicle. Simultaneously, the rear vehicle's driver and TC, section leader two, open their doors and dismount to fight, while their gunner continued firing from his position in the gun platform on top of the Hummer. Immediately, all three fall under heavy return machinegun fire, wounded. The driver of the middle vehicle saw them fall out the rearview mirror, dismounts and sprints to get into the third vehicle and take up the SAW on top the vehicle. The Squad's medic dismounts from that third vehicle, and joined by the first vehicle's driver (CLS trained) who sprinted back to join him, begins combat life-saving techniques to treat the three wounded MPs. The gunner on the floor of the second vehicle is revived by his TC, the squad leader, and he climbs back into the .50 cal and opens fire. The Squad leader dismounted with his M4 carbine, and 2 hand grenades, grabbed the section leader out of the first vehicle who had rendered radio reports of their first contact. The two of them, squad leader Staff Sergeant and team leader Sergeant with her M4 and M203 grenade launcher, rush the nearest ditch about 20 meters [22yd] away to start clearing the natural trenchline. The enemy has gone into the ditches and is hiding behind several small trees in the back of the lot. The .50 cal and SAW flanking fire tears apart the ten enemy in the lead trenchline. (Quoted in Burden 2006: 170)

This account is useful because it shows the SAW working alongside other firepower available to the American unit, including M4 Carbines, M203 grenade launchers, and the heavy thumping power of the Browning .50-caliber M2HB heavy machine gun. Despite the enemy taking cover in ditches, the combined firepower of the SAW and the M2HB have a devastating effect on these positions. The author of the account also notes that

Those seven Americans (with the three wounded) killed in total 24 heavily armed enemy, wounded 6 (two later died), and captured one



Firearms seized by Colombian police in 2013 are put on display, and include a Minimi plus what appear to be the barrel and gas assembly for an M60. (Policía Nacional de Los Colombianos CC-BY-SA-2.0)

unwounded, who feigned injury to escape the fight. They seized 22 AK-47s, 6x RPG launchers w/16 rockets, 13x RPK machineguns, 3x PKM machineguns, 40 hand grenades, 123 fully loaded 30-rd AK magazines, 52 empty mags, and 10 belts of 2500 rds of PK ammo. (Quoted in Burden 2006: 170)

Given the heavy weaponry evidently available to the Iraqi insurgents, including 16 machine guns, it is clear just how essential firepower such as that provided by SAW was to winning this engagement.

As well as the SAW has served in Iraq, it has also performed extreme feats in Afghanistan. The following account comes from a major US Army combat study of an action in Wanat in Afghanistan's Waygal Valley on July 13, 2008, when Company C, 2nd Battalion, 503rd Parachute Infantry Regiment, fought for four hours at close quarters against a major Taliban attack, suffering nine killed in the process. This brief excerpt from what is a long report sees the SAW in action, but also reveals something about the issue of stoppages:

When the action began, the two engineers who were operating the Bobcat next to the mortar area reinforced Phillips' men in the mortar pit. There, the defenders used whatever weapons were available to them, firing personal weapons furiously into the nearby trees and aiming 40mm grenades at more distant enemy positions. Without any machine guns of their own, the mortarmen had to use M4 assault rifles firing at the maximum rate of fire simply to suppress the enemy in order to survive. In this way, Phillips burned out a series of three M4s. He then picked up an M249 SAW belonging to the engineers and tried to fire it but it failed to shoot. Mortarman Queck had previously tried to fire the SAW but it was jammed. Another trooper later fired it successfully after changing its barrel. Queck instead fired an AT-4 rocket launcher he found at one of the buildings from which enemy fire was coming. Soldiers nearby followed up Queck's effort with hand grenades. [...]

The initial fight at the mortar pit, described earlier in this chapter, illustrated this. In other positions as well, the SAWs and, in particular, the M4s, experienced difficulty maintaining such a rate after the barrels



This Japan Ground Self-Defense Force Minimi features the telescopic stock and is equipped with a sling for carriage, but which can also aid underarm or hip-mounted shooting. (Itaiyaki31 CC-BY-3.0)

got excessively hot. When that occurred, the weapons would jam, as happened to Phillips. Without heavier weapons, the enemy fire forced the Americans to return an equal volume of fire or risk the enemy overrunning the position. One young platoon member later complained, “I ran through my ammo ‘til my SAW would not work anymore despite the ‘Febreze’ bottle of CLP I dumped into it.” Soldiers were, on occasion, able to bring back into action previously jammed weapons. As mentioned above, the engineers’ SAW that failed to work in the mortar pit fight was later used in another location after its barrel was replaced. In the midst of intense enemy fire, one paratrooper described how he “grabbed the engineer’s weapon that was left at our position and which was a SAW and started laying down about 800–1,000

rounds at the bazaar and wood line around the mosque.” (US Army 2008: 144–49)

From the first paragraph of this account, we get a clear sense of the terrifying anxiety that results from a weapon malfunction. What is equally clear, especially in the second paragraph, is that to counter an attack the soldiers had to use the SAWs to the very limits of their endurance, ripping through the ammunition at an astonishing rate. Note how in the last sentence one SAW delivers up to 1,000 rounds of fire. Given the extremely high rates of fire, it is in many ways unsurprising – even at just the level of statistical likelihood – that the SAWs suffered from some stoppages and malfunctions. At the same time, it is evident that the volume of fire that the SAW can deliver was absolutely essential for the Americans to achieve parity of fire with the enemy, let alone fire superiority. These hard-worked guns are truly force multipliers.



The Daewoo Precision Industries K3 is a South Korean imitation of the Minimi, which has achieved some export success in its own right. (Shotgunlee CC-BY-3.0)



IMPACT

The SAW and its future

The practical impact of the Minimi on the battlefield is hard to deny. It has been distributed so widely across the world's armed forces, and has been used so intensively in combat, that it is one of the most influential small arms of the late 20th century and the early 21st century. It has been a central component of infantry-squad firepower in several major wars, most especially in Iraq and Afghanistan, where it has shown itself to be a powerful tool for attrition and suppression.

That being said, it would be a glaring omission to avoid recent discussions in the defense world about both the impact and the relevance of the Minimi to the modern infantry fire team. The US Marine Corps' decision to replace their SAWs with the new M27 Infantry Automatic Rifle (IAR) in the automatic-rifle role is a case in point. By looking at the justification for this change, and also the extent to which the new thinking is reflected in other armies, we can come to a more rounded judgment of the Minimi's impact and its potential legacy.

FIREPOWER PERFORMANCE

First, we need to address the Minimi's impact in a very literal way. Here we return to the issue of ammunition type, specifically the perceived and argued virtues of the 5.56mm round when compared to the 7.62×51mm NATO cartridge. Although this issue is just as relative to other weapon types as it is to the 5.56mm version of the Minimi, it is fundamental to making judgments about the efficacy of the Minimi on the battlefield.

As soon as the 5.56mm NATO round appeared on the scene in the 1960s, it gathered its supporters and its detractors, both equally vocal. For the supporters, the 5.56mm offered key benefits such as the ability of

soldiers to carry a greater volume of ammunition, a very high velocity and therefore flat trajectory over practical combat ranges, good (if not better) penetration of mild-steel plate compared to the 7.62mm out to 600m (656yd), plus a more controllable recoil experience, making weapons more accurate when fired. Those lamenting the loss of the 7.62mm cartridge, however, pointed to the fact that the larger round delivers more penetration over range and through cover of various types, offers the ability to engage more distant targets convincingly, encourages the soldier to deliver better-aimed fire, and offers a more decisive terminal ballistics profile, “taking down” opponents through greater wounding characteristics.

This debate is extremely complex, and full justice cannot be given to it here. It does need to be addressed in part, however, because it resurfaced with a vengeance from 2001, mainly in the context of battlefield reports from Afghanistan. In a nutshell, there were increasing complaints that at ranges beyond 500m (547yd), which are actually common in the Afghan hinterland, the 5.56mm round just did not have the reach or power required. This was particularly so in the case of the short-barrel M4 Carbine, with American soldiers often finding themselves outranged by Taliban insurgents armed with 7.62×39mm AK assault rifles. Other complaints included the 5.56mm’s apparent lack of ability to penetrate body armor or physical structures such as dried mud or brick, and the perceived survivability of insurgents even when struck by several 5.56mm rounds.

Although the M4 Carbine was the weapon primarily in the sights of this discussion, the M249 SAW has also been implicated. This is clear from a major 2009 study of the debate entitled, revealingly, *Increasing Small Arms Lethality in Afghanistan: Taking Back the Infantry Half-Kilometer*, by Major Thomas P. Ehrhart. The essence of Ehrhart’s argument is that in Afghanistan engagements are regularly fought out beyond 300m (328yd), beyond which the capabilities of the 5.56mm round trail off:

The U.S. entered World War I with a small professional Army trained in marksmanship. It filled its ranks with volunteers and conscripts and traditional marksmanship training took too much time. Between World War I and the end of the Vietnam War, the U.S. Army was a conscript Army that relied on suppressive fire, not marksmanship, and trained accordingly. The problem is suppressive fire does not do well with a light, barely lethal bullet at the distances of engagements in Afghanistan ...

For examples of M855 ineffectiveness, you can look at some of the live fire accidents that have occurred. One notable incident occurred in 1991, when then Lieutenant Colonel David H. Petraeus was shot in the chest by an M855 round from an M249 squad automatic weapon. He walked out of the hospital several days after the accident. Had the round performed optimally, he likely would have been killed.

The author witnessed a soldier shot in the shoulder from a distance of 75 meters [82yd] during a night live fire exercise and the soldier was walking around smoking a cigarette twenty minutes after the accident. A soldier in the author’s battalion had a negligent discharge with an M249 squad automatic weapon, during the initial invasion of Iraq in 2003, in a closed space of a building. Poorly instructed, he disassembled

the weapon before unloading it and the weapon fired at the cyclic rate, firing approximately 100 rounds. From a distance of three meters [9.8ft], four soldiers were hit in the extremities and none sustained life-threatening wounds.

In general, the requirements for the infantry squad are that they have weapons capable of reliable incapacitation from close range to a distance of 500 meters [547yd]. This capability does not exist in the current family of 5.56-mm ammunition, either with military or with commercial off the shelf ammunition, though efforts are underway to remedy the situation. (Ehrhart 2009: 24–28)

There are several aspects of Ehrhart's analysis that I would challenge, particularly some of the statements about the terminal ballistics of the 5.56mm round. Although Ehrhart does discuss in some detail terminal ballistics theory, including the excellent work by Dr. Martin L. Fackler, the founder and former head of the Wound Ballistics Laboratory and a world-renowned authority on the subject, what he does not address is the extremely critical issue of shot placement. While it is true that certain rounds can inflict more serious wounds than others, there is no simple equation between the size of the round and lethality. It would be far more preferable, for example, to be struck on the lower arm by a 7.62mm rifle round than it would be to be hit in the temple by a .22 rimfire bullet. If there is good and prompt medical care available, the majority of soldiers wounded by small-arms ammunition will survive the event, regardless of the caliber of bullet they are struck by. Furthermore, it is one of the abiding myths of the Hollywood age that being struck by a single bullet will result in the victim's instant incapacitation and death. This is patently untrue, as any trauma surgeon will tell you. The primary mechanisms of a fatal wound are blood loss, leading to volume shock, or a strike on the central nervous system – most commonly the former, which can take time ranging from minutes to hours.

Given these facts, the incidents in which soldiers survived 5.56mm SAW impacts are actually perfectly understandable in physiological terms, and do not constitute an essential criticism of the cartridge or the gun. The fact that none of the soldiers sustained "life-threatening wounds" is simply because they were hit only in the extremities. A key further point is that in the incidents described the discharges were accidental; the outcome of these episodes would likely have been very different if the people who fired the shots were deliberately aiming at the target and firing repeatedly to achieve a takedown.



A US Army soldier armed with an M249 Para works alongside a member of the Afghan National Police. Mounted on the M249 Para's front rail is an AN/PEQ-2 Infrared Target Pointer/Illuminator/Aiming Laser. (US Army)

I am not arguing that there is literally no difference at all between calibers in terms of factors such as range and penetration. I also acknowledge that at extended ranges, say beyond 600m (656yd), a short-barrel M4 is probably not the best weapon to engage a distant enemy. The key to the composition of unit firepower is having a mix of weapons of different capabilities, for every weapon has its limitations that have to be balanced by the mix of unit weaponry. A powerful 7.62mm battle rifle, for example, will be excellent at exchanging fire over open countryside at long range, but in close-quarters urban combat a fast-firing and light M4 would be supreme. (We should remember the high levels of confidence expressed for the M4 in the CNA's *Soldier Perspectives* report.)

In recent times, an increasing number of analysts have pushed back against the criticisms of the 5.56mm round. One contributor to the January 6, 2012 edition of *Small Arms Defense Journal*, for example, argues that there are no official documents stating that the 5.56mm is the definitive problem. The author states:

One quite often reads and hears of the benefits of 7.62mm over 5.56mm. The truth is, however, most of the time the opposite. The benefits of 5.56mm over 7.62mm are:

- Equal lethality against unprotected enemies.
- Half the mass (12g–24g) [0.42oz–0.84oz].
- Half the volume.
- Reduced recoil and signature (noise and flash) that allows for a faster second shot.
- Better penetration in thin metal plates.
- Flatter trajectory and shorter time of flight out to 700m [766yd].
- Lighter weapons.
- Higher hit probability.

The last bullet-point refers to the fact that the soldier is not afraid of the recoil and noise, and so can concentrate on his stance, weapon control, aiming, and trigger pull. Several nations have reported this when they changed from 7.62mm caliber to 5.56mm. (Arvidsson 2012)



A Japanese soldier practices delivering bursts from the shoulder with the Minimi, the blank-firing cartridge belt curved around the pistol grip to control the flow of cartridges into the weapon. (Rikujoujitei Boueisho CC-BY-SA-3.0)

Given that the 5.56mm cartridge does appear to be adequate *for the purposes it was designed to fulfill*, we can focus squarely on the Minimi itself, and argue that it is precisely because it is chambered for the 5.56mm cartridge that it has had the impact it has achieved. The Minimi was designed to increase the suppressive firepower capability of an infantry fire team or vehicle-mounted unit,

while also being small and light enough to be transported easily around the battlefield by one man. Given the extra stability provided by its mounting systems, plus the accuracy offered by the various sight options, the Minimi is quite capable of reaching out to targets up to 1,000m (1,094yd) distant. Anything beyond that, or if the unit requires heavy on-target destruction, will have to call on more powerful weapons, such as the MAG GPMG or Browning M2 HMG; but by firing the 5.56mm cartridge, the SAW remains controllable for one-man usage and can also deliver the high rates of fire demanded by localized suppression.

Much of this argument has had a rather theoretical feel to it, but it will now take a very tangible turn, as we shall see in the context of the US Marine Corps.

THE MARINES, THE SAW, AND THE IAR

In 2010 the US Marine Corps began fielding a new weapon in its front-line units: the 5.56mm M27 IAR. The introduction of this weapon signaled a profound change in the Marines' official attitude to the M249. Not only is the IAR intended to replace many of the M249s at squad level, it also represents a fundamental shift in the philosophy of how firepower is delivered on the front line, questioning the impact the Minimi has had in the past, and will have in the future.

We have seen how the M249 gathered some adverse press coverage during its service in Afghanistan and Iraq. By this time, however, the US Marine Corps had already begun to investigate the requirement for an IAR – essentially a weapon that had all the portability and ergonomic familiarity of a standard rifle, but which could deliver heavier and more accurate fire over range. Essentially, the IAR concept was similar to that of the Browning Automatic Rifle LMG used in World War II. Crucially, the IAR would actually occupy the position currently taken by that of the M249. The IAR program officially began in July 2005, and after five years of trials and testing a candidate for adoption finally emerged – the Heckler & Koch HK416, which with modification became the M27 IAR.

The M27 is a very different animal from the Minimi. It is a gas-operated, short-stroke piston automatic rifle, chambered once again for the 5.56mm NATO cartridge. It has a free-floating barrel, which, when combined with modern sights such as the Sight Unit, SU-258/PVQ Squad Day Optic (a version of the Trijicon ACOG), makes it extremely accurate, even at ranges beyond 1,000m (1,094yd). It has a cyclical rate of fire of 700–850rd/min but – and this is crucial to note – it is fed from standard 30-round STANAG magazines. This system choice, and the fact that the barrel is not changeable, means that the practical rate of fire is more in the region of 35rd/min.

Given that the IAR has such different capabilities when compared to the M249, and the fact that this weapon is replacing many SAWs in front-line service, this decision makes a profound philosophical statement. Basically, the US Marine Corps has opted for less volume and more accuracy, in terms of the IAR's suppressive firepower. A lengthy statement in favor of this proposition, by virtue of its criticism of the Minimi, is

found in Ray Grundy's 2001 article entitled "The M249 Light Machine Gun in the Automatic Rifle Role" (see Bibliography for the web address). Through very detailed and careful reasoning, Grundy criticizes the M249 on the following grounds:

- Poor reliability on the battlefield.
- A lack of ammunition compatibility between the M249 and the M16 rifle.
- An unnecessarily high use of ammunition. ("Show me the Marine who can move while shooting greater than 85rpm using 3–5-round bursts, and I'll show you a Marine who is not engaging targets properly and wasting valuable ammunition.")
- The barrel-change facility is often both impractical in combat and affects the accuracy of the gun, as the barrel change requires weapon re-zeroing.
- Accuracy tests conducted by the Marine Corps Combat Training Center appeared to demonstrate that Marines armed with a Colt AR consistently hit more targets than SAW gunners engaging the same targets.
- The SAW requires a high-level of training to master – other riflemen cannot operate the weapon unless trained to do so.

Given that the Grundy article was written in 2001, it makes no specific comment on the IAR, although it can be easily co-opted to support his proposition. Crucially, it also does not observe any of the subsequent critical improvements in the SAW, as embodied in the Mk 3 variant. Nevertheless, as a general conclusion, Grundy states that

I fail to see the logic in the continued support for the M249 System. As a general purpose LMG it has merit. However, when used in the AR role, it is a liability to the squad. The weapon remains too heavy. It negates commonality of ammunition in the fire team, will not operate very well with magazines, can only be fired accurately from the supported position, and is often carried in condition three (rounds on the feed tray, bolt forward on an empty chamber, weapon on fire) during movement to contact because we are not confident in the system. These problems are compounded by the fact it remains a very difficult weapon to master. Imagine the advantages of having weapons in the rifle squad with identical characteristics, using the same ammunition. (Grundy 2001)

Focusing on the final sentence, the M27 IAR has been introduced precisely to offer these advantages.

The debate about this striking decision on the part of the US Marine Corps has naturally generated a lot of heat, with people arguing on either side of the divide. In the US Marine Corps itself the move to the IAR seems to have been generally accepted with a positive spirit, backed by apparently good initial feedback from soldiers who have used the M27 IAR in the field in Afghanistan. By way of example, an article written in the September 10, 2012 issue of *Small Arms Defence Journal* stated:



Friends and foes of the M249 Squad Automatic Weapon in the U.S. Marine Corps' infantry fire teams have been engaged in often fierce verbal firefights dating back years before this innovative light machine gun entered Leatherneck service; soon after the Army adopted FN's MINIMI in 1984. While the reasons for this are many and varied, astute observers often cite two main points of contention:

- Advocates of belt fed weapons like the M249 admire their relative portability and high volume of fire at critical times in offensive and defensive actions.
- Critics say the 5.56mm SAW's hefty 20+ pound combat weight slows movement and reliability issues too often degrade the gun's claimed firepower advantage.

This second group has argued long and strenuously for an "Infantry Automatic Rifle" that's both lighter and simpler than the SAW, with similar combat effectiveness from better accuracy and realistic capability in full auto and sustained fire.

Now, more than a quarter century after the Belgian belt-fed joined the Marines, and a decade after the infantry automatic rifle tests by 2nd Battalion 7th Marine Regiment, the IAR camp has won the argument. "After a rigorous testing process, both in garrison and deployed environments, and in-depth consultation with weapons experts through the Corps, the Commandant approved the fielding of the M27 Infantry Automatic Rifle. Fielding of the IAR will significantly enhance the ability of infantrymen to gain and maintain fire superiority, reduce the fighting load and provide them with a more ergonomic and accurate weapons system that can keep up during the assault." (USMC press statement, June 2011) (Quoted in Bruce 2012)

US Marines conduct a squad attack exercise, providing support from the 5.56mm M27 Infantry Automatic Rifle (IAR), the weapon destined to replace many M249s in US Marine Corps service.
(USMC)

An article in the official MarinesBlog, tellingly entitled "M249 becomes an Endangered Species in the Corps," also embraces the IAR. The article

chooses to focus more on the advantages of mechanical simplicity and also user commonality:

"The IAR has fewer moving parts than the SAW does, making it a lot more 'grunt friendly,'" said Lance Cpl. Tyler Shaulis, an IAR gunner with 2nd Battalion, 7th Marines, Regimental Combat Team 7. "It has a direct piston system, so there are fewer jams. It stays cleaner longer, with less carbon build up after it's been fired. The muscle memory stays the same with it as it would an M16. If an IAR gunner goes down, any Marine could grab the weapon and lay down accurate suppressive fire without thinking twice."

For the Marines at this austere forward operating base, the change has been a positive one, with only a few minor suggestions for the new rifle issued to them in early October before the deployment.

"It's a huge improvement to have a more accurate weapon," said Staff Sgt. Mathew Henderson, the platoon commander of Personal Security Detachment, 2nd Bn., 7th Marines, currently on his fourth combat deployment. "We want to broaden the application of its use. For instance, using an IAR in a sniper platoon instead of a SAW would be a huge advantage." (Mercure 2012)

This statement is particularly interesting because the focal point of the final paragraph is about accuracy, not suppressive fire. In some ways this is very much in keeping with the philosophy of the US Marine Corps, which has as part of its "Rifleman's Creed": "My rifle and I know that what counts in war is not the rounds we fire, the noise of our burst, nor the smoke we make. We know that it is the hits that count. We will hit ..."

It is not just the US Marine Corps that is now conducting an evaluation of the role of the SAW/Minimi in its infantry fire teams. By way of example, a recent article (March 15, 2016) published in *Jane's Defence Weekly* explains how the British MoD is set to review the role of belt-fed machine guns, specifically the Minimi, within its infantry fire teams. In their current composition, the fire team consists of one 5.56×45mm SA80A2 IW, one SA80A2 IW fitted with a 40mm under-barrel grenade launcher (UGL), one 7.62×51mm L129A1 Sharpshooter Rifle, and one 5.56×45mm FN Herstal Para Minimi LMG. Under the new propositions, the Minimi would be dropped and not replaced, its suppressing-fire roles taken over by the UGL and the L129A1, the latter of which is a very similar weapon in concept to the IAR.

These developments are very significant when discussing the impact of the Minimi, because they question both the past and future impact of the weapon. As a professional author and historian, rather than a serving soldier, I obviously have to be careful about making judgments from the safety of an office chair. In US service at least, the M249 SAW experienced its fair share of troubles; and given the combat prowess of the US Marine Corps, they would not make the shift to another weapon lightly and without first having conducted significant testing. Furthermore, the M27 IAR has not been in service long enough for us to have the benefit of detailed analytical reports about its performance in combat, although

some indications suggest that SAW gunners were initially reluctant to give up their belt-fed weapons, but gradually grew to appreciate the IAR once they became accustomed to using it.

For all its faults, many of which have been rectified, we must acknowledge the fact that the Minimi has enabled the front-line infantry fire team to deploy a source of heavy suppressive firepower wherever it goes. Suppressive firepower is not necessarily about accuracy. It is about the ability to lay down a heavy volume of bullets around a specific area, creating a “beaten zone” in which the enemy can scarcely survive, let alone maneuver. It is hard to see how, even with its additional accuracy, the M27 IAR – a weapon with a practical rate of fire of 35rd/min – can perform this task, given some of the combat descriptions related earlier.

There are growing voices now emerging in the military press that are also questioning the shift away from the Minimi. One article in the *Military Gazette* from October 2015 called the move to the IAR the “great leap backwards.” The author, Michael Cessna, argues that full-automatic weapons are by nature inaccurate, but that their inaccuracy and rate of fire are what create the invaluable area-suppression effects. He also raises questions about why the US Army is not moving to adopt the IAR, and why the US Marine Corps is not making the move to adopt the M27 as its standard rifle (cost, of course, could be the main consideration there).

In another article, worth quoting at length, writer Tom Hudson also feels that there are questions to be answered:

It is obvious that the Marine Corps is changing their minds on how they want their squads to fight. They have witnessed firsthand how their tactics stack up in war time and have decided to make a fairly drastic change. The question is, is this the right rifle for the job? I have concerns with the M27. The first is that it is magazine fed. A SAW gunner carried 1000 rounds into battle; the IAR gunner will have to carry 33 magazines to carry the same combat load. Where will he put all of these magazines? If the IAR is being used as a long-distance, accuracy-based weapon, why not use a larger caliber round? Why not use the M14? My Army training taught me that when ambushed, we were to return maximum fire to deter the enemy. Now that the Marine Infantry Squad doesn’t have the SAW, they will have to rely on M16s and the M27 to return fire. My feeling is that the SAW will be missed in these instances. The other question I have is this: if the M27 is so much better than the



The Para version of the Minimi is used in the French Army, here in the hands of a French soldier taking part in a joint NATO exercise in Germany, May 2008.
(US Army)



As well as in the arid and hot conditions of the Middle East, the Minimi has been tested in Arctic environments. Here a Royal Marine Commando prepares to fire his L110A1 during a live-fire exercise in Norway. (POA(Phot) Sean Clee/MOD)

M16A4, then why not replace the M16 with the M27?

The whole idea of having a magazine-fed automatic rifle hearkens to the days of the M1918 Browning Automatic Rifle (BAR). In fact, HK has called the M27 the baby brother to the BAR. I think this may prove to be a prophetic comparison. The BAR saw quite a bit of action, especially in WWII, and performed admirably. But in the late 1950s military commanders wanted a belt-fed, open-bolt, LMG that their squads could deploy. They wanted something that could provide better suppressing fire than the BAR could. Sound familiar? Will history repeat itself? In 10 years will the Marines be dusting off the M249s that they have in reserve? Only time will tell, but my best guess is that they will. (Hudson 2013)

The question Hudson raises about ammunition capacity is especially pertinent. Some sources have suggested that the IAR gunner's magazines will be distributed among the wider fire team, but this seems to be an unnecessary complication of the gunner's self-sufficiency. Given what has already been noted about concerns regarding the performance of the 5.56mm round, it is interesting that the US Marine Corps did not opt for a 7.62mm solution – there are some fine full-automatic assault rifles now available with the 7.62mm caliber option, such as the FN SCAR.

It is my feeling that the debate over the Minimi and the IAR-type rifle has not resolved itself yet. In many ways the Minimi is a hard act to follow. When it is working well – and the majority of most modern weapons do – there is scarcely a better tool for generating localized defensive or offensive firepower. For nearly two generations of troops, the Minimi has been the primary means by which the balance of fire superiority has been tipped in their favor. *That* has been – and remains – the Minimi's most significant impact.

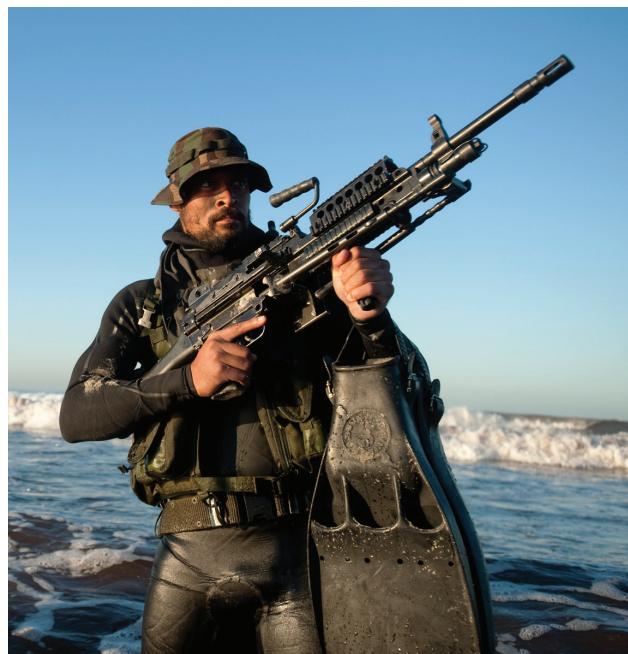


CONCLUSION

Despite the introduction of weapons such as the IAR, this is not the beginning of the end of the Minimi story. Far from it. The Minimi, in its various forms, is massively integrated into the world's armies, and despite some of the shifts in the United States, many authorities still think that belt-fed machine guns such as the Minimi perform an irreplaceable and invaluable role in the firepower of a small infantry unit. Furthermore, we must always remember that evolution of the Minimi is ongoing, with FN solving problems and adding new capabilities. The recent release of the Mk 3 variant, for example, means that the Minimi is keeping pace with continual developments in the world of firearms technology and accessories, as well as overcoming technical issues. Indeed, the "accessories" part of the equation is becoming ever more important. Adding devices such as rangefinders, advanced night-vision scopes, and laser targeting systems can transform the Minimi's capabilities, and can also counteract some of the criticisms made about the gun in the rationalization of the IAR.

We must also remind ourselves that the Minimi is not the only player in the field – it has competition that actually supports the idea of the belt-fed 5.56mm support weapon. Israel, for example, took inspiration from the Minimi during the 1990s to create the similar-looking 5.56mm Negev LMG, introduced in 1997 to replace the Galil

A US Navy SEAL emerges from the ocean with his M249 SAW at the ready. The weapon would need heavy cleaning to ensure no malfunctions from salt intrusion occur. (US Navy)



Not a Minimi, but a 5.56mm Negev LMG in the hands of an Israel Defense Forces (IDF) soldier standing guard in Nablus on the West Bank. The Negev is one of several machine guns inspired by the Minimi. (IDF CC-BY-SA-2.0)



ARM. The Negev has been used heavily in action in the hands of the Israel Defense Forces (IDF), and its qualities have seen it adopted by several other countries, including Azerbaijan, Colombia, Estonia, Georgia, the Republic of Macedonia, Thailand, Ukraine, and Vietnam. In 2012 a 7.62mm version, the Negev N7, was introduced, reflecting the general international desire for an LMG with improved reach and penetration. Another competitor, and again one that can be easily confused with the Minimi in terms of appearance, is the Heckler & Koch MG4. Like the Minimi and the Negev, it is a belt-fed, gas-operated 5.56mm LMG, with an effective range of up to 1,000m (1,094yd). As well as being the standard platoon-level support weapon of the Bundeswehr (German Army), the MG4 is also used by forces in Malaysia, Portugal, South Africa, and Spain.

The fact that the Minimi has been imitated, including by countries such as Israel, which has regular combat operational commitments, is both flattering to the Minimi principle, and also an acknowledgment that the tactical concept of the squad LMG is widely accepted.

At the time of writing, the Minimi is already more than four decades old. It is a weapon that has received intensive front-line testing; and although there have been critics and undoubted problems, it has largely survived with its reputation intact. It is possible that the Minimi's status will change in many armies over the next decade, to reflect shifts in tactical thinking toward a new IAR; but as the world's ordnance authorities do so, caution needs to be exercised, for no one past conflict provides all the lessons as to how all future conflicts will be fought. What remains constant, however, is the fact that in infantry combat soldiers will always need a source of automatic firepower to suppress and attrite the enemy – and in this role, the Minimi excels.

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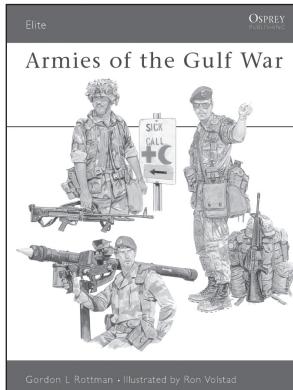
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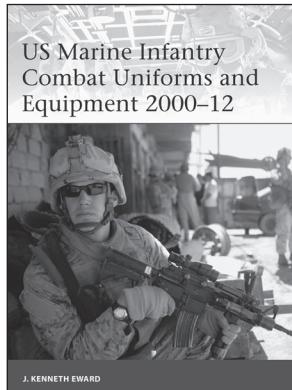
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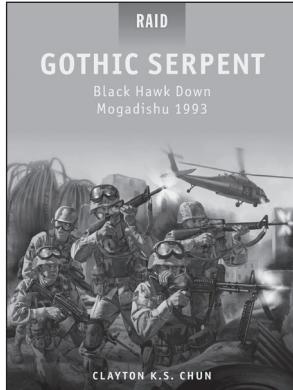


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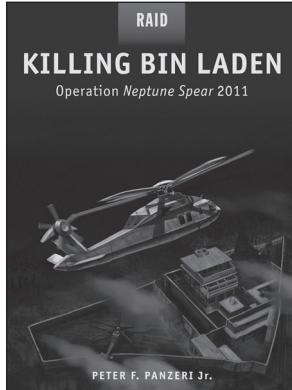
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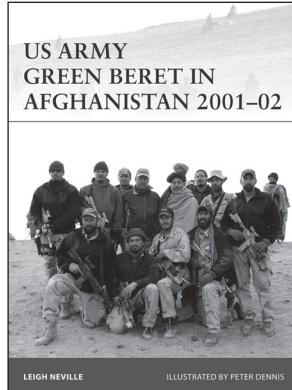
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